C. ITOH
DIGITAL PRODUCTS

USER MANUAL

Dot Matrix Printer Models

Prowriter

Prowriter II

C. ITOH DIGITAL PRODUCTS, INC.

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USER MANUAL

DOT MATRIX PRINTER MODELS

PROWRITER

PROWRITER II

Printed in the United States of America.

REV. 1.2

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"This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

     o reorient the receiving antenna

     o relocate the computer with respect to the receiver

     o move the computer away from the receiver

     o plug the computer into a different outlet so that computer and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV Interference Problems". This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4."

INTRODUCTION

WHY A PRINTER MANUAL?

Leafing through this manual may, at first, give you an anxious
twinge. Can I learn all that stuff? More important, why
should I?

Good questions. Fortunately, all that printer stuff can be
easily and pleasantly absorbed if we take it one step at a
time. As for the second point: why should anyone learn it?
Two reasons: utility and economics. You will find the many
PROWRITER 8510, 1550 printer functions useful. There are
some differences between the PROWRITER Models A and B as
noted in Appendix VI.

Some of you have glanced back and seen the PRINCIPLES OF
OPERATION Chapter -- and cringed. You didn't bargain for any
technical stuff. Yet another printer owner has just returned
here from looking at IF YOU'RE NEW AT THIS and thought "A
beginner's manual. Phooey!" (Probably he said something else,
but this is a family manual.)

Relax. The technical explanations are here for those who want
them, but they needn't be read to utilize your printer. And
the chapter for computer novices can be skipped by experts
without losing information.

The purpose of this manual is to get you friendly with your
printer right away. Then, after you're proudly producing
reams of standard text, we'll show you how to do all kinds of
neat things -- like different character sets, expanded and
compressed type, and graphics.

MANY THRILLS AWAIT THE READER!

See? Isn't that worth reading further for?

A NOTE ABOUT MODELS

The PROWRITER 8510A and PROWRITER II 1550 are identical except
that the 8510A has a 10-inch platen, providing 80 columns of
normal (pica) point; the 1550 has a 15-inch platen that permits
136 pica columns. For convenience, we'll refer to the printer
as PROWRITER from now on.

WHAT ARE THE PREREQUISITES FOR THIS COURSE?

There's got to be a catch, right? Only a little one. To use
this printer in all its glory you need a programming knowledge
of BASIC. But without any programming knowledge you can do
standard text printing and your computer programs (like word
processing, forms, and other goodies).

MANUAL ORGANIZATION

Here's a rundown of the major topics included in this
manual. Look it over before you continue; you'll see
that we'll take things in easy steps. Before you know
it you'll be a printing pro!

The Chapters that follow are:
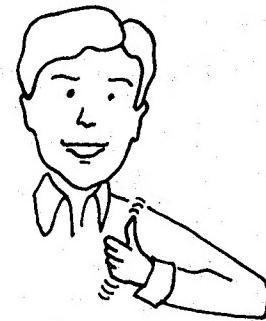
CHAPTER ONE: UNPACKING AND ASSEMBLY

Don't pass over this chapter! It's easy to skip since you want
to get right down to business, but follow each step to prevent
problems later on.

CHAPTER TWO: IF YOU'RE NEW AT THIS

This is the one for folks with no previous experience. Those
of you with previous experience are invited to take a peek, too.

CHAPTER THREE: GETTING STARTED

Here you'll learn basic printer mechanics -- paper loading,
switches, indicators, and so forth. Then (lo and behold!)
we'll print some straight text, using simple formats and commands.

CHAPTER FOUR: THE VERSATILE PRINTER

Now you're ready to print boldface type, compressed, elongated
or underlined type -- even graphics. The sky's the limit!

CHAPTER FIVE: HOW IT WORKS

The basic principles of operation for you technical types.

CHAPTER SIX: KEEPING THE WHEELS TURNING -- MAINTENANCE

A few simple checks and adjustments will keep your printer
running at the same dandy pace it did when you first turned it
on.

CHAPTER SEVEN: WHEN THINGS GO WRONG -- TROUBLESHOOTING

When things don't go according to plan the problem is often
easy to correct. This chapter shows you how.

Both Chapters six and seven are non-technical, so don't
overlook them. Refer to APPENDIX I to connect the PROWRITER
to your computer. The other Appendices are references.

Okay -- let's get started!

CHAPTER ONE: Unpacking and Assembly

UNPACKING YOUR PRINTER

You've opened the printer box and, hopefully, this manual,
before doing anything else. Please -- resist the urge! What
urge? The uncontrollable desire to toss this book aside and
tear off the wrappers, plug the pretty thing in, and start
printing. I know it's just like Christmas, but ...

FOLLOW THESE STEPS TO UNPACK ......

The printer comes packed between molded foam material that
will protect it from anything less than a direct bomb blast.
Lift off the top half, then remove the ribbon cassette and set
it aside.

Ribbon cassette
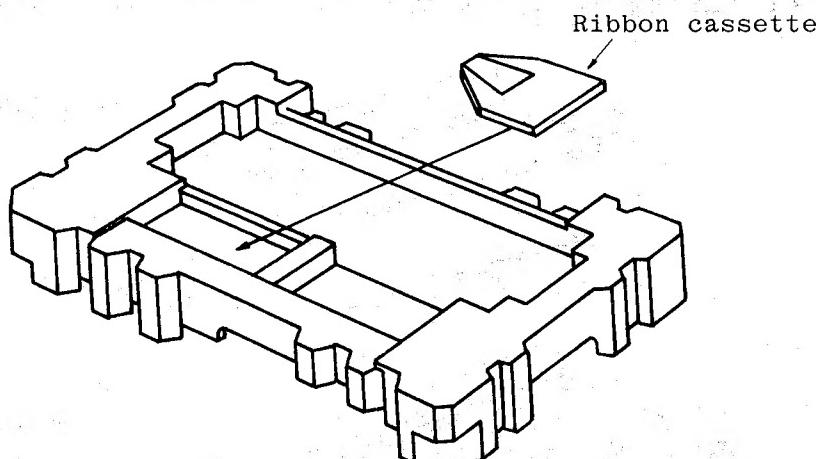
Grasp the printer with both hands and lift it straight out of
the box. The bottom half of the protective molding may come
with it. Sometimes it helps to have another person hold the
carton. DON'T hold onto the printer knob while you do this!

Printer

Knob

Outer carton
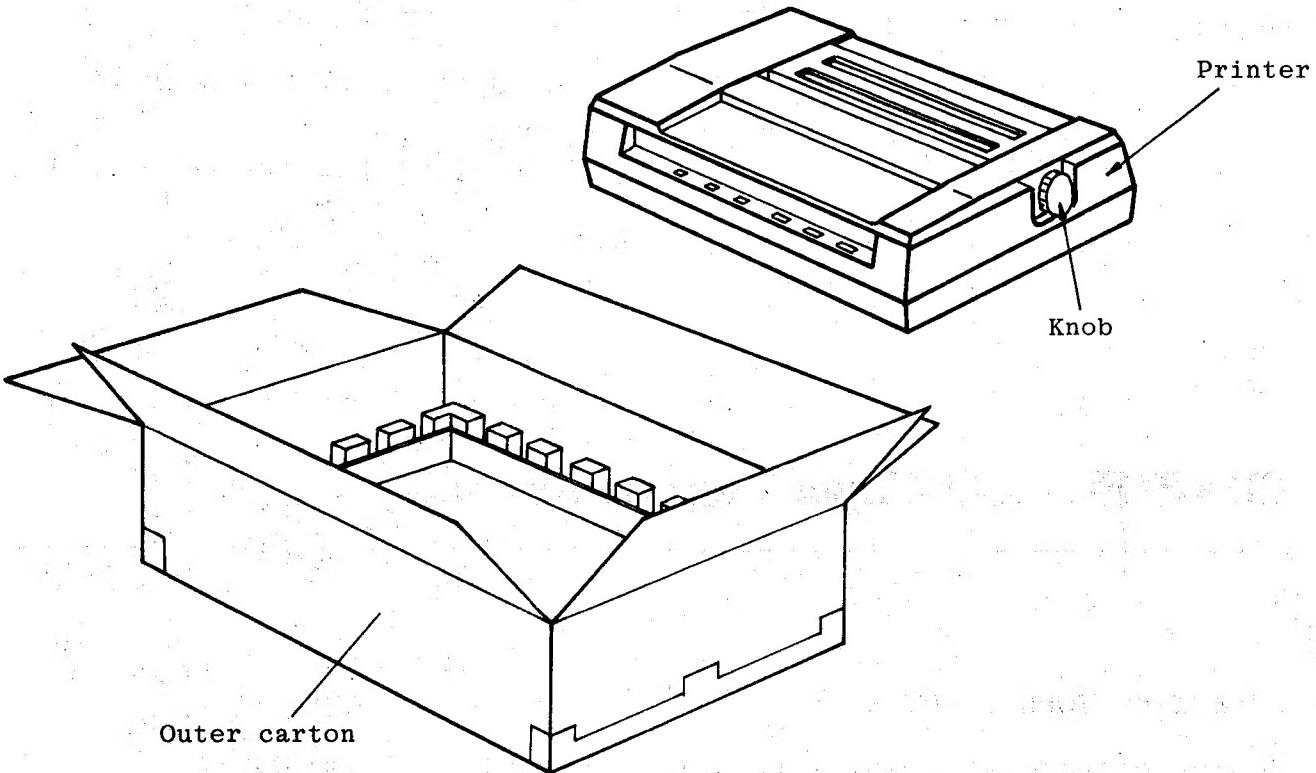
Remove the AC power cord and set it aside.

Place the printer on a solid surface and remove the packing
bag. Take a moment to admire it
(the printer, not the bag).
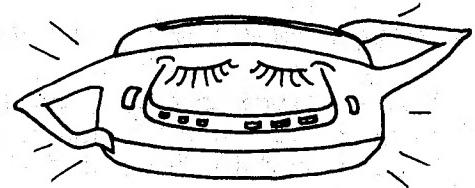
Now remove the carrier cover and
gently pull out the cardboard stopper. The stopper keeps the
printer intact during shipping and has no further use.

Carrier cover

Stopper

Top cover
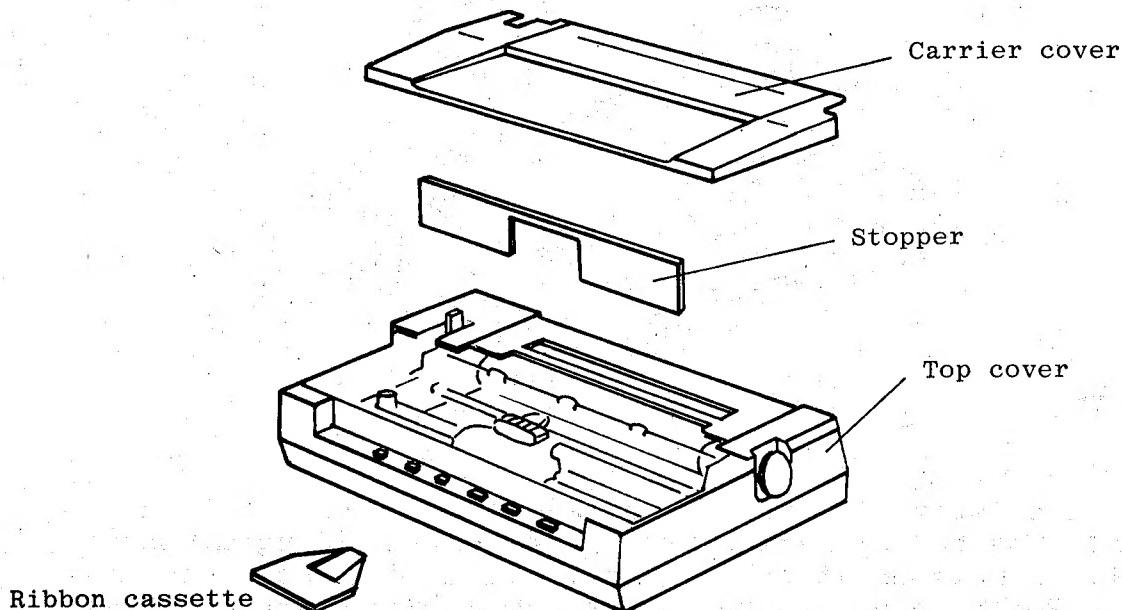
Ribbon cassette

ASSEMBLING THE PRINTER

We're getting there! Remember where you put the ribbon cassette
a minute ago? Pick it up and identify its parts:
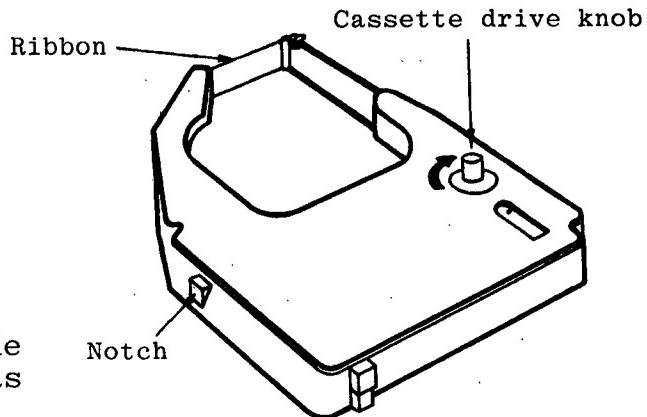
Turn the cassette drive knob in
the direction of the arrow
until the ribbon shows no slack.
Don't overtighten. Now hold the
back of the cassette and insert
the ribbon between the ribbon guide
plate and the ribbon guide, just as
you would with a typewriter.
Push the cassette firmly into the ribbon
deck. If it won't go all the way don't force it -- turn the
cassette drive knob clockwise a notch and try again.

Connect the ac power cord by pushing the female connector on
the cord into the male connector on the right rear side of the
printer. Don't plug it in yet (soon!).

It's time to load the paper. Like installing the ribbon it's
easy to do and doesn't have to be repeated often. Here are
some more steps:

o First, make sure you have the right kind of paper.
   Your PROWRITER accepts standard, fan-feed printer
   paper with a perforation separation of 9 inches
   and a maximum width of 9.5 inches. The 1550 accepts
   15-inch sheets, with perforation separation of
   14 inches. Set the paper either on the table behind
   the printer or (if you have a big box of it) on the
   floor behind it. Bring the paper straight back to
   the rear of the printer.
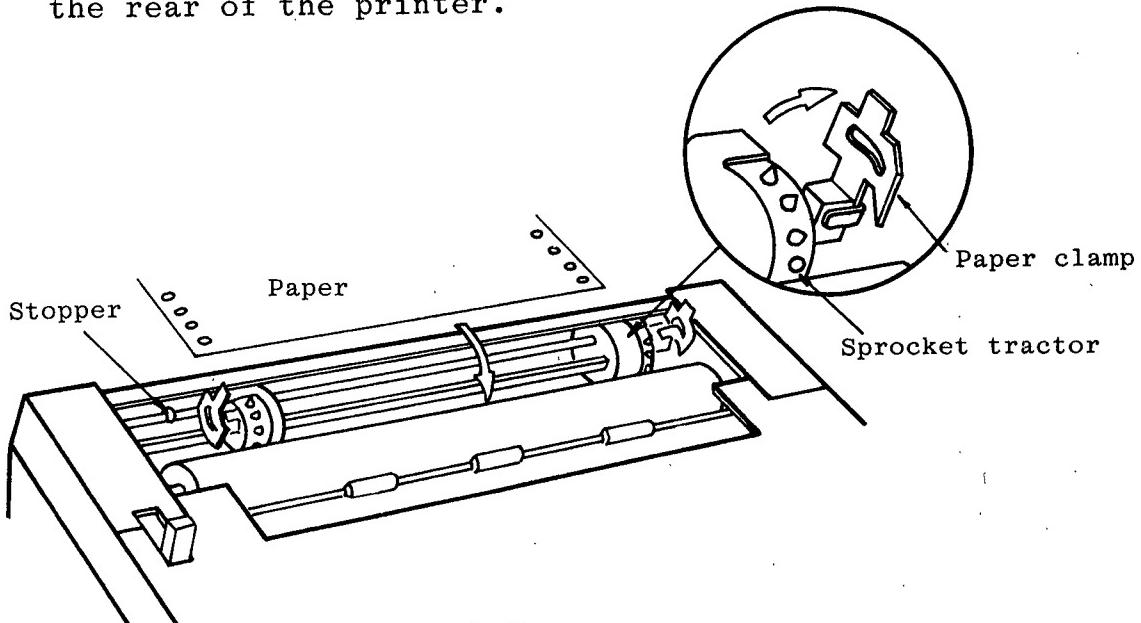
Lift up the paper clamps attached to the right and
left sprocket tractors. This exposes the toothed
wheels (sprocket pins) that pull the paper through
the printer without slipping.

o   Place the end of the paper over the sprockets and
    fit the paper sprocket holes into the right and
    left sprocket pins.

NOTICE!

If (oh, no!!) the paper is too wide or narrow for the pins,
don't cry or call your mother. Don't even return the paper.
Instead push the right sprocket lever (shown below) to loosen
the sprocket and move the sprocket
pins until the paper holes fit
right in. Then snap the sprocket
lever forward. Do this with the
left sprocket if necessary to
center the paper.

Sprocket
lever
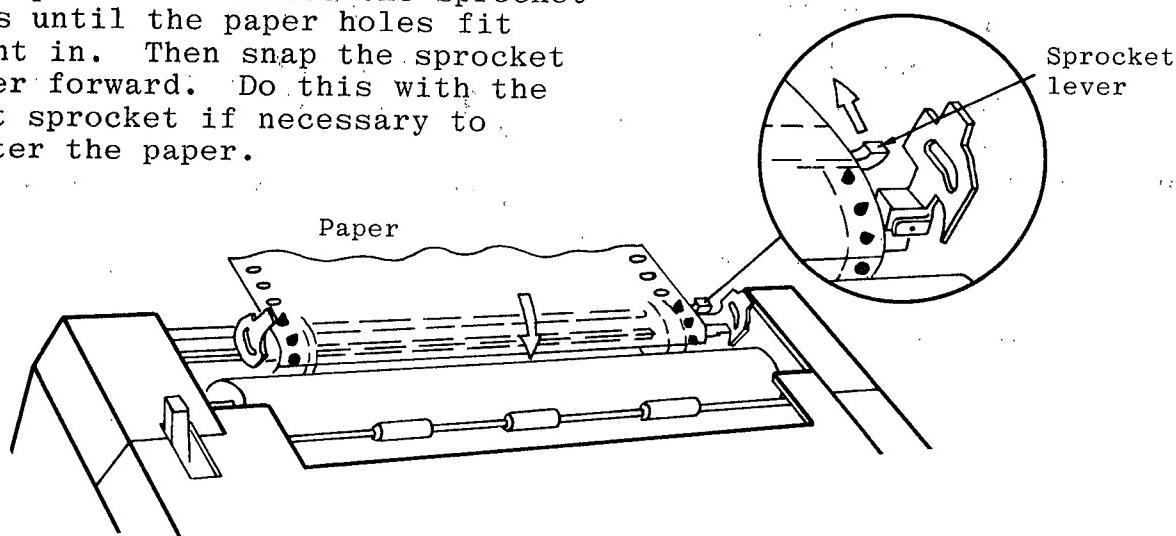
Paper

o   Push down on the paper clamps of the sprocket
    tractors, putting the paper firmly into the
    printer's clutches. Then turn the platen knob
    clockwise, bringing the paper out on the front of
    the platen. Push the roller shaft and the release
    lever back into their original position.

Paper end

Platen knob

Release
lever

Sprocket tractor

Paper cover

Platen knob

Top cover

Paper cutter

Carrier cover

Operator panel

Release lever

Bottom enclosure

Power switch

Carrier cover

Paper cover

Paper loading

Platen knob

Fuse

Power cord

Serial interface connector
(option)

Parallel interface connector
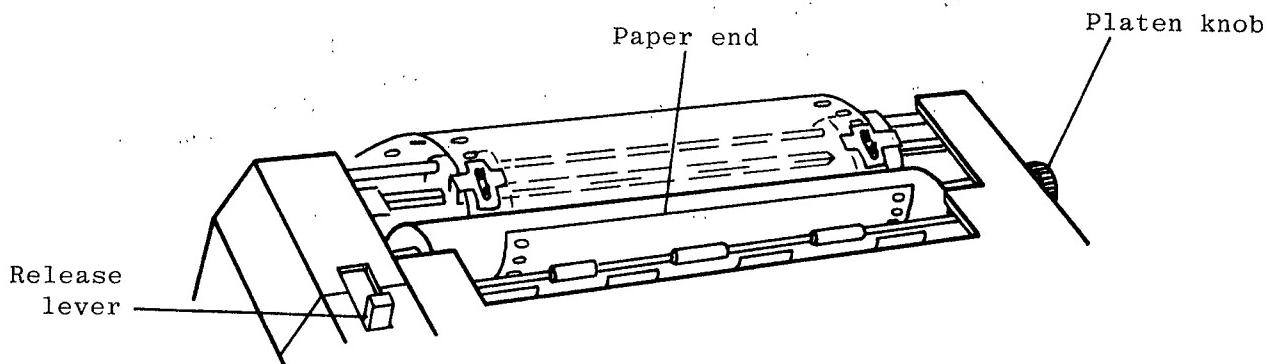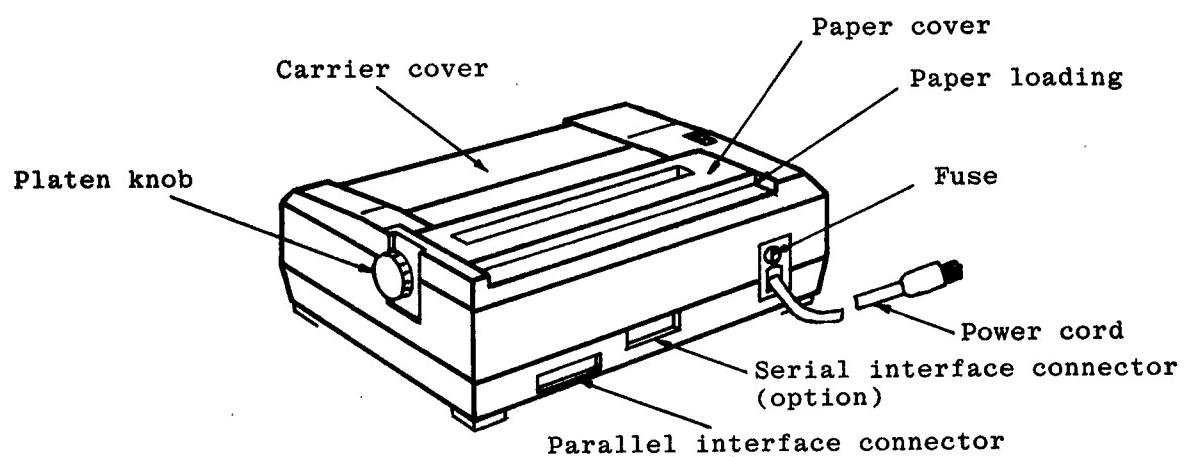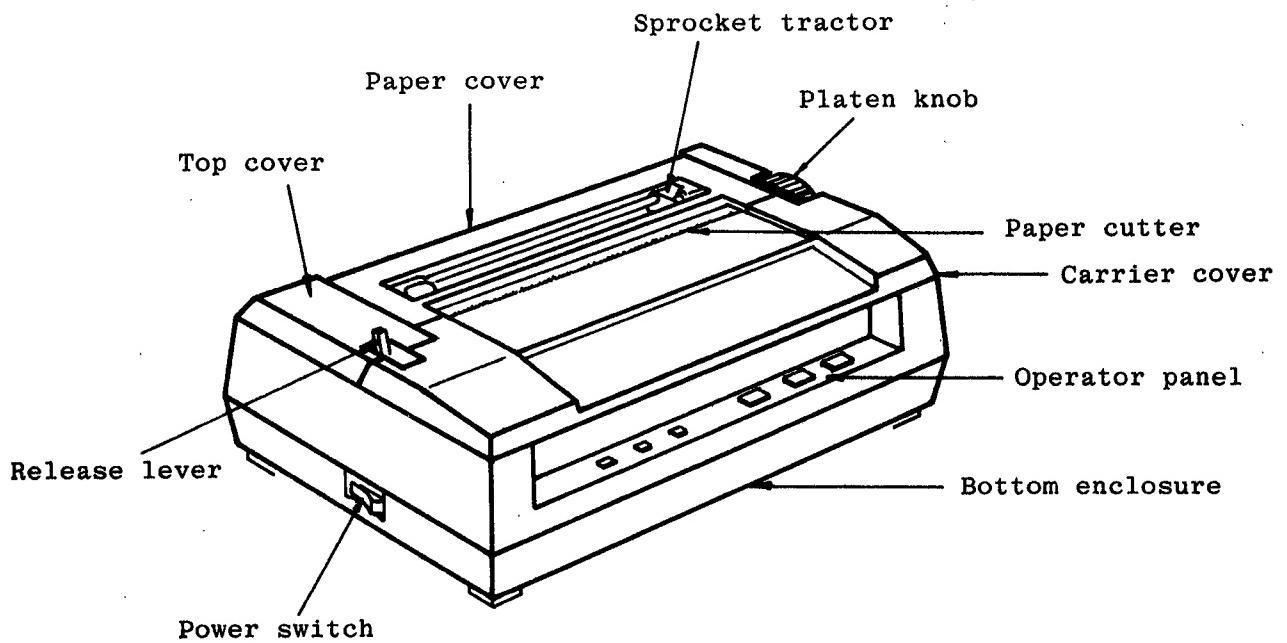
FRICTION FEED

Friction feed can be used to print single sheets. To use the friction-feed mode, first move the selector lever left of the carriage to the front FRICTION position. Then feed the paper through the same path as with pin feed, except that the paper moves over the closed sprockets.

We've not only unpacked and assembled your PROWRITER, it now sports a ribbon and paper. All set to go -- almost.

Almost? Yep -- we have to plug it in. (So many people forget this little detail.) Look on the left side of the printer and make sure that the ON-OFF switch is in the OFF position -- that is, with the mark out. This is what it looks like when it's ON:

Power switch

(ON)
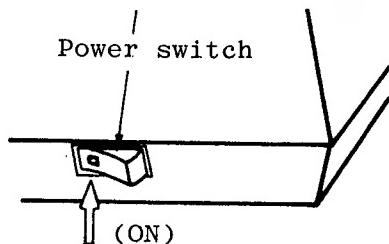
The plug of your power cord is the grounded type, with three prongs. Insert the plug into a grounded outlet. DON'T TRY TO BYPASS THE GROUNDED PLUG. YOU COULD RECEIVE A DANGEROUS SHOCK.

INITIAL TESTS

WHOA!

Before you get out your computer cable and prepare to type in text, we have a little test to perform. It's simple, painless, and interesting. It's the printer self test, which checks all printer operations. This brings us to the part you've been patiently waiting for:
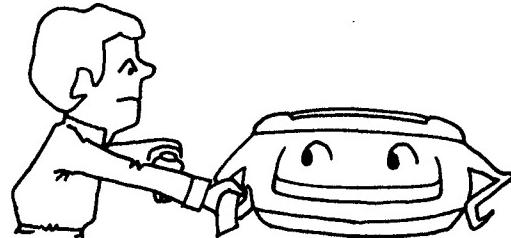
TURN THE POWER ON!

Now two things should happen.

   o The green POWER light on the control panel should go on. More about the control panel in a minute.

   o The carriage should return to the left, or home position.

If both things happened, turn the power off. So far, so good ...

(By the way -- if things don't go as promised in any instruction, look at Chapter Seven before panic sets in.)

Now for the self test. Set the paper so that the perforated
top of a page is even with the top of the print head.

Hold down the TOF (Top of Form) button on the control panel.
At the same time, press POWER on. Then release both buttons.
ZAP!! The printer works! It automatically prints a pre-
programmed test pattern, does a line feed (returns to the left
position), and does it again. And again .. and ...

```
 !"#$%&'()*+,-./0123456789:;<=>?@    ?QRSTUVWXYZ[\]^_`abcdefghijklmno
!"#$%&'()*+,-./0123456789:;<=>?@AB    ?STUVWXYZ[\]^_`abcdefghijklmnop
"#$%&'()*+,-./0123456789:;<=>?@ABCL    TUVWXYZ[\]^_`abcdefghijklmnopq
#$%&'()*+,-./0123456789:;<=>?@ABCR    ,UVWXYZ[\]^_`abcdefghijklmnopqr
$%&'()*+,-./0123456789:;<=>?@ABC    STUVWXYZ[\]^_`abcdefghijklmnopqrs
%&'()*+,-./0123456789:;<=>?@ABCDEF    'UWXYZ[\]^_`abcdefghijklmnopqrst
&'()*+,-./0123456789:;<=>?@ABCDEFG'    XYZ[\]^_`abcdefghijklmnopqrstu
'()*+,-./0123456789:;<=>?@ABCDEF     UXYZ[\]^_`abcdefghijklmnopqrstuv
()*+,-./0123456789:;<=>?@ABCDEFGHI.   7[\]^_`abcdefghijklmnopqrstuvw
)*+,-./0123456789:;<=>?@ABCDEFGHIJK'   \]^_`abcdefghijklmnopqrstuvwx
*+,-./0123456789:;<=>?@ABCDEFGHIJ'   L\]^_`abcdefghijklmnopqrstuvwxy
+,-./0123456789:;<=>?@ABCDEFGHI`   <[\]^_`abcdefghijklmnopqrstuvwxyz
,-./0123456789:;<=>?@ABCDEFGHI.   7[\]^_`abcdefghijklmnopqrstuvwxyz(
-./0123456789:;<=>?@ABCDEFGHIJKLM.   `^_`abcdefghijklmnopqrstuvwxyz(!
./0123456789:;<=>?@ABCDEFGHIJKLM'   J^_`abcdefghijklmnopqrstuvwxyz(!)
/0123456789:;<=>?@ABCDEFGHIJKLI.   ]^_`abcdefghijklmnopqrstuvwxyz(!)~
```

Nice, but how do we get it to stop? Turn the power off. And
by the way, what does this pattern tell us?

The test pattern tells us plenty. Examine it carefully for
missed or broken letters. Are the lines crooked? Do they
run into each other? If the pattern shows faulty printing, go
to Chapter Seven before you continue.

THE CONTROL PANEL

The control panel lets you see what's going on, and lets you
do basic printer business.

```
 _____
|                                                           |
|   SEL □    PE □    POWER □    SEL ▣    LF ▣    TOF ▣        |
|_____|
```

LED (green)   Push switch

LED (red)
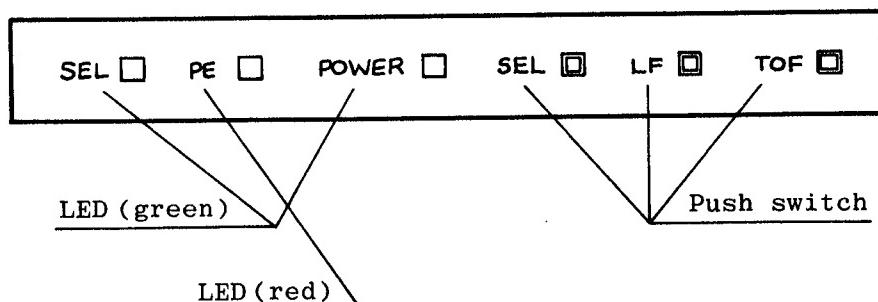
Reading from left, SEL and PE are green lights (LEDs), POWER
is a red LED, while SEL, LF, and TOF are push switches.

POWER indicates power on, naturally.

PE (Paper Empty) comes on when you're out of paper.

SEL (light and switch) select and deselect the printer.
That is, when you push the SEL switch and the green SEL
light comes on, the printer is ready to receive data.
Push it again and the SEL light goes out: the printer
is on standby and will not respond to print commands from
the computer.

LF performs a line feed, or full carriage return,
positioning the carriage at the left, or home, position.
It operates only when the printer is not SELected.

TOF stands for Top of Form. It advances the paper to the
top of the next page. The paper will advance to the
same spot on the next page, not necessarily the top
(unless it was there to begin with). TOF operates only
when the printer is not SELected.

Turn the power ON and try both the LF and TOF functions.

CONNECTING YOUR PRINTER TO THE COMPUTER

Your PROWRITER matches up with just about every microcomputer
on the market ... and a few that haven't yet been put on the
market. Interconnection is simple and fast. To make it even
easier we've supplied specific instructions for the major
computers. Now go to APPENDIX I, make the connections and then,
tally ho!

CHAPTER TWO: If You're New at This

This chapter is for non-computer types who are anything from slightly bewildered to panic-stricken at the prospect of understanding all the jargon, technical instructions, and other hoo-hah that bombards them in a world they never made. Take heart. We will discuss elementary concepts, explain terms, and pull back the veil. And nobody has to know you read it here.

Those of you whose lunch hour chatter is sprinkled with bits and bytes, speeds and feeds, can go on to Chapter Three. (Of course if you want to take a look, I won't tell.)

WHAT DOES A PRINTER DO?

Sometimes we get so busy talking about the fine points of a device or a concept that we neglect the quavering hand raised in the back of the room: "But what's it for?"
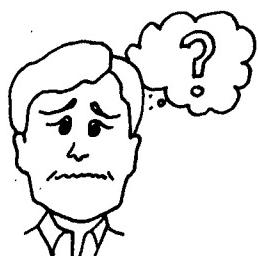
Ahem. A printer provides a written record of information that resides in a computer's memory. Jargon term: it gives us HARD COPY. Printers of all types were married to computers way back when calculating devices were great hulks that resided in laboratories instead of family rooms.

Long before video display screens were used for any computer, teletype machines and specially-modified typewriters were the computer's only way of communicating. Hard copy was the only copy. In the 1970s, television-like video display screens became a quick way for the computer operator to see what was going on behind the panels.

Video displays have great advantages: they provide nearly instantaneous information which can easily reflect changes. They also have two big drawbacks: they display only a few lines of information at one time, and, when you turn off the

computer -- there goes your information.

The printer's advantages and drawbacks are just the opposite. This is why most practical systems today have both a video display and a printer. A printer provides a permanent record, but another printout must be made for each change in information. However, long lists of information can be printed and saved for later use.

HOW THE PRINTER WORKS

We might've titled this section, "How a Printer Knows What to Print," since the inner workings of the printer are beyond the scope of this chapter. (We will see why your PROWRITER is called a dot matrix device, however.)

PRINT COMMANDS

A printer receives electronically-coded commands both from the computer and from itself, one at a time. Each command tells the printer to do something. The computer commands are transmitted from computer to printer through the INTERFACE CABLE. An interface may be parallel, serial, or current loop.
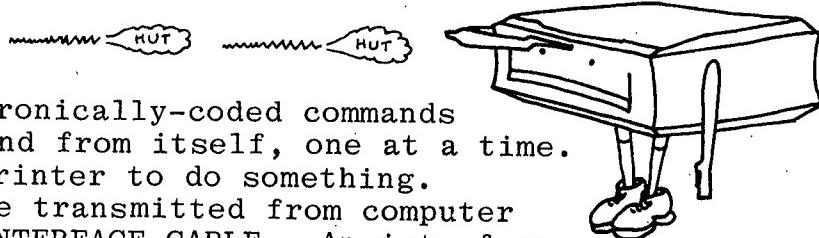
The commands the printer receives fall into two major categories: print commands and functional commands.

    PRINT commands tell the printer to print a character.

    FUNCTIONAL commands tell the printer to perform another task: return the carriage, underline, change to a different kind of character, and so forth.

Print commands and functional commands are mixed together, and some functional commands are automatic. For example, after the printer receives a certain number of print commands it automatically generates a functional command to return the carriage to the left home position. The computer has nothing to do with this printer-generated command.

When specialized programs such as word processing are in use, all commands are automatic -- just sit back and watch it print! In this instance, the printer is said to be under SOFTWARE CONTROL. (Note that the software must be configured for the correct printer.)

If you are printing from a BASIC program (or from any other language), each printer command must be programmed separately. This is really good news -- it means you can take advantage of the tremendous scope and versatility of your PROWRITER, and tailor each command to your needs.

Programming each command is not nearly as tedious as it might sound: you only need to do it once for each occurrence. For example, a single line printer command tells the printer to print all text following it:

      10 LPRINT "THIS IS AN EXAMPLE LINE."

(This BASIC command is for TRS-80 computers. Others are similar.)

Often, then, print commands are just the good old commands we've been using for the video screen, modified to go to the printer. Now suppose we want to end our print line right after the text instead of waiting for the automatic return at the end of the line. Then we'd like text to be printed and underlined on the new line. To do this we use three functional commands:

      10 LPRINT "THIS IS AN EXAMPLE LINE."

      20 (a command to return the carriage)

      30 (a command to go to the next line)

      40 (a command to underline subsequent text)

      50 LPRINT "THIS IS ANOTHER LINE."

Functional commands take whatever form the computer and printer are set up to recognize. The PROWRITER includes a powerful set of functional commands that are easy to use.

In BASIC, functional commands are represented by the CHR$(n) instruction. Remember that one? It returns the character represented by the ASCII code n. (The ASCII code is a number assigned to each alphanumeric and special character.) If your computer is handy run this little program:

      10 PRINT CHR$(68)

The screen displays: D

D is the character represented by ASCII code 68. ASCII codes are also assigned to major computer functions, such as ESCape.

Now let's return to our other program and use actual commands. The command for carriage return is CHR$(13). The command to move to the next line (called a LINE FEED) is CHR$(10), and the command to underline all subsequent text characters is CHR$(27);CHR$(88). This last is a compound command.

Now our program looks like this:

      10 LPRINT "THIS IS AN EXAMPLE LINE."

      20 LPRINT CHR$(13);

      30 LPRINT CHR$(10);

```
40 LPRINT CHR$(27);CHR$(88);

50 LPRINT "THIS IS ANOTHER LINE.";CHR$(27);CHR$(89)
```

When RUN the program prints:

THIS IS AN EXAMPLE LINE.

THIS IS ANOTHER LINE.

In practice these commands can be condensed into fewer lines and separated by semicolons:

```
10 LPRINT "THIS IS AN EXAMPLE LINE."

20 LPRINT CHR$(13);CHR$(10);CHR$(27);CHR$(88);

30 LPRINT "THIS IS ANOTHER LINE.";CHR$(27);CHR$(89)
```

Now you should be asking two questions: what are all those semicolons doing there, and why is the underline command composed of two CHR$ instructions instead of one?

Each command or partial command to the printer must be separated by a semicolon. This includes program lines that combine commands and text:

```
60 LPRINT CHR$(27);CHR$(88); "THIS IS A SHORT LINE";CHR$(13);

70 LPRINT CHR$(10);CHR$(27);CHR$(89)
```

This program will print THIS IS A SHORT LINE and then turn off the underline function on the next printer line. Notice several things: CHR$ commands were mixed right in with text, separated by semicolons. The answer to the semicolon question is: because the syntax of most BASIC language versions demand semicolons between different statements of this type. If that sounds like a copout it really isn't -- any language must have some means of telling the computer that a separate command is coming next; otherwise commands and statements would crash into each other.

RUN 60 to see the last program. Then edit or rewrite the program, removing the semicolons. RUN 60 and see what happens (chuckle). This is the nice thing about computers. In most cases you can experiment to your heart's content without causing damage.
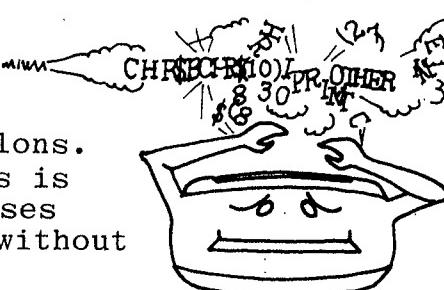
These programs are listed for Microsoft BASIC. If you have an APPLE computer, add line 5 PR#1 (or whatever the printer port), and change all LPRINT statements to PRINT.

Okay -- that was easy. Now, how come the underline command uses two CHR$ instructions? Again, we must plead the nature of the beast. Earlier I implied that there was only one kind of functional command. Well, the printer recognizes two kinds of

functional commands: A simple form called a function code, and a two-part form called an escape sequence. Function codes are commands to the printer in the form of a number (ASCII code). Escape sequences are numbers preceded by ASCII code for the ESCape command. (ESC appears on the keyboard on the APPLE and some other computers.)

The ASCII code for ESC is 27. Our underline command, above, then, is ESC X. For the computer to accept it and transmit it to the printer, we must translate it into BASIC:

        10 LPRINT CHR$(27);CHR$(88) -- produce the ASCII codes for
        ESC 88.

        20 LPRINT CHR$(27);CHR$(88) -- send this instruction to
        the printer!

The following chapters contain all the information you'll need on specific codes and their formats. You already know more than many people who use printers every day, but before we end this chapter there are a couple of details you should learn to make you a real expert.

SERIAL AND PARALLEL INTERFACES

Let's be honest. The computer world is full of nice people and good books, both of which tend to spout words and phrases that make no sense whatsoever to the average intelligent person. What is maddening is that these utterances are often conveyed without explanation -- and usually with the attitude that everybody knows what they mean. Serial and parallel interfaces for printers are innocent creatures, often misunderstood by lack of definition.

Here are some definitions:

PRINTER INTERFACE: any device that connects your printer to your computer. It may include a printed circuit board that plugs into your computer, and it almost always includes a cable. The printed circuit board contains electronics that prepares computer signals for their journey to the printer. The cable takes the signals to the printer.

SERIAL AND PARALLEL INTERFACES: the two flavors of interface commonly used with microcomputers. As a user, you only have to know a few things about these interfaces:

        o   Serial interfaces send information to the printer
            one bit (0 or 1) at a time, one right after the other.

        o   Parallel interfaces send information to the printer
            eight bits (one byte) at a time.

        o   Some computers and printers accept only serial or
            parallel interfaces; most now accept both.

o   YOU CAN'T CONNECT A PARALLEL INTERFACE PORT TO A
     SERIAL PRINTER, OR VICE VERSA. No fireworks will
     occur; it just won't work.

Your PROWRITER accepts parallel input, and will accept serial
as well as current loop interfaces if the option is included.

DOT MATRIX IS NOT A WOMAN MATHEMATICIAN

We've covered some interesting ground in this chapter. But
what about the name of the printer itself? What does the term
"dot matrix" mean when we apply it to a printer?

The dot matrix process is an ingenious method of forming the
character a column at a time on the print head and transferring
it to paper. The print head has a set of electronically-
activated thin rods (needles) arranged in a vertical column.
Characters are built on either a 8 x 8 or 7 x 9 matrix, much
the same way that characters are built on a CRT tube.

As the carriage moves horizontally the needles needed for that
matrix column are fired. With the five-column matrix the
needles must fire five times to create a letter. To print an A,
for example, the bottom five needles are fired at the same time
to produce the left-hand vertical stroke. Then the appropriate
needles are fired together on succeeding horizontal steps to
make the remainder of the A.
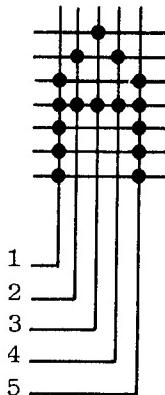
The matrix codes of all characters are stored in the printer's
permanent memory. As the print head moves across the paper, the
printer receives character ASCII codes from the computer and
converts them to matrix codes for the print head, using circuitry
called a character generator. Each signal from the character
generator activates a needle or set of needles.

Dot matrix printers are versatile. PROWRITER can print standard
pica or elite type, elongated type, compressed, boldface -- and
more. Your commands change the response of the character generator,
then the dot head prints -- to your order.

CONGRATULATIONS ...

You can continue to the next chapter knowing that
there will be no confusing surprises -- only happy ones.
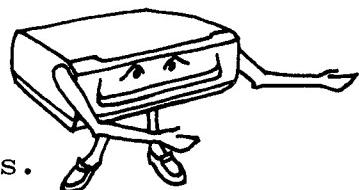
CHAPTER THREE: Getting Started

AND AWAY WE GO

We've accomplished a lot so far. You've unpacked your PROWRITER,
assembled the parts (including the ribbon and paper), and read
APPENDIX I to connect it to your particular computer. Finally,
if you're new at the computer and printer business, you've read
Chapter Two.

In this chapter we'll learn to print commercial programs,
such as word processing and finance, print straight text
from a BASIC program, and use major print commands in that
text for functions such as spacing, underlines, and boldface
type. If you've cribbed a bit on reading the previous
chapters go back and read them now.

FIRST THINGS FIRST

Get in the habit of going through this check list before you
run programs that use your printer. It will save you much
grief later on.

So, before you begin:

      o   Printer paper and ribbon okay
          (red PE light off?)

      o   Power on light (Green)?

      o   Printer on line
          (green SEL light on)?

      o   Printer correctly connected to
          computer, as described
          in APPENDIX I?
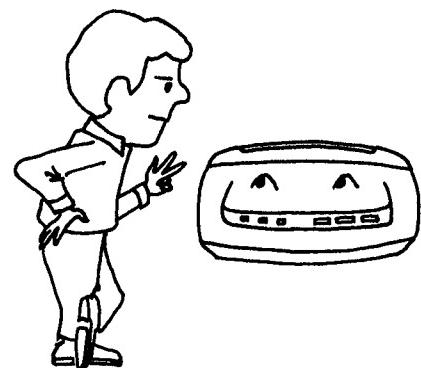
PRINTING WITH COMMERCIAL PROGRAMS

This is a very short section. Printing from commercial programs
such as word processing and accounting packages is automatic.
The commands we're going to learn are built into these programs
and if your system is set up and checked out as we've described,
printing will take place when it should, and in the proper format.
Pretty neat, huh? (Note that word processors have to be
SOFTWARE configured for this printer.)

PRINTING SIMPLE TEXT

Throughout this manual we'll use print
conventions that apply to the TRS-80 series
of computers. Don't panic -- it's very
simple to convert from one computer to another.
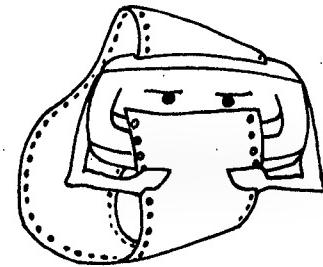
TRS-80 family computers use a printer command in the form:

        10 LPRINT "THIS LINE WILL BE PRINTED ON THE PRINTER"

        20 PRINT "THIS LINE WILL BE PRINTED ON THE SCREEN"

APPLE computers use the PRINT command, and preface commands
bound for the printer with the address of the printer port
number (PR#). The printer is usually port number 1 (PR#1);
the screen is always port number zero (PR#0). The same program
on the APPLE computer is

        10 PR#1

        20 PRINT "THIS LINE WILL BE PRINTED ON THE PRINTER"

        30 PRINT "SO WILL THIS ONE"

        40 PR#0

        50 PRINT "THIS LINE WILL BE PRINTED ON THE SCREEN"

If you're not sure about your computer's printer statements,
consult your computer manual before you continue.

What you've just witnessed is, by the way, the fundamental method
of using BASIC to enter text to be printed. We use a print-to-
printer command instead of a print-to-screen command. Text is
entered in program lines, using the same rules that apply when
we write to the video screen -- with a few more thrown in to take
advantage of PROWRITER'S versatility. A block of straight text,
then, might look like this:

        10 LPRINT "THIS IS A DULL PIECE OF TEXT MATERIAL, BUT
        HARDLY MORE THAN ONE MIGHT EXPECT FOR SUCH AN EXERCISE.
        MOREOVER, IT IS QUITE DIFFICULT TO COME UP WITH
        STIMULATING PROSE AT ALL TIMES. YOU, OF COURSE, UNDER-
        STAND THE DIFFICULTIES INH";

        20 LPRINT "ERENT IN THIS PRACTICE."

Enter this program <u>exactly</u> as it is printed here. When you run
it, notice a couple of things on the printout: The printout
is automatically broken at the end of the line, with no text
loss, and the break in INHERENT does not appear.

The first situation is due to a feature built into your PROWRITER.
It returns the carriage at the end of the line, no matter what
the text -- unless you've inserted special commands. The
second feature illustrates how we get around a computer limitation:
most microcomputers will accept a limited amount of information
on each line. With most microcomputers you can enter up to
244 characters on a print line and edit the line up to 255.
When this limit is reached you simply can't enter more informa-
tion on that line. (Try it.)

Adding the trailing semicolon at the end of the first program
statement chains it directly to the next.

SCREEN PRINT COMMANDS AND THE PRINTER

The commands you use to format text on the video screen will,
for the most part, work with the printer. The only one that
doesn't is PRINT@ -- a Microsoft command that prints at a
specified location on the video screen. Since the printer is
not a screen it ... well, you get the idea. And, of course, the
PRINT # -1 command is for cassette tape.

Let's review the standard print commands and then try an example.
In Microsoft BASIC the commands available are:

        LPRINT   LPRINT TAB (number)

        LPRINT USING   LPRINT STRING$ (number,"character")

        STRING$ does not work in Applesoft.

We've used LPRINT already. Like its video display counterpart,
it prints variable and string values as well.

Run this program:

        10 FOR N = 1 TO 10

        20 LPRINT N

        30 NEXT

Each value of the variable N is printed in a column. Now
change line 20:

        20 LPRINT N;

Ahah! When we run this version we see that the semicolon has
the same effect on the printer as on the display screen: it
suppresses the carriage return/line feed commands, keeping the

printed values on the same line. Experiment with this using variables and strings, then come back.

LPRINT USING is primarily used for business forms and works exactly as it does on the display screen. So do the other commands, as this demonstration shows:

```
10 LPRINT "PRINT ZONE 1", "PRINT ZONE 2", "PRINT ZONE 3"

20 LPRINT TAB(22) "YOU CAN SELECT" TAB(40) "ANY TAB
SETTINGS YOU WANT!"

30 LPRINT STRING$(50,"*")

35 LPRINT: LPRINT

40 LPRINT "COMBINE TAB AND THE STRING$ FUNCTIONS"

50 FOR N = 1 TO 10

60 LPRINT TAB (N) STRING$((50-N),"*")

70 NEXT
```

This is pretty neat -- we can do anything we did on the screen, right there on the printer. Did you notice, too, that the printer's wider carriage permits more copy per line? That's the only difference. And it's just the beginning. Take some time with your own programs, using these standard print functions, before you continue. Some microcomputers will have slight differences in language structure -- refer to your manual.

FOR PRINTERS ONLY

Now to the realm of the PROWRITER --
doing things with text your display screen never
dreamed of. From now on we'll be talking about
function codes, escape sequences, and the CHR$ command.
The CHR$ command is fully explained in your BASIC
manual. If you're not familiar with these topics (or you need
a bit of a refresher), read Chapter Two before continuing.
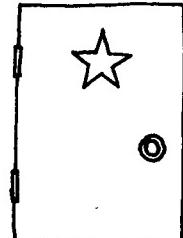
Our approach to command descriptions is this: each command is included in a functional category, so you can relate commands to each other. The command is described, with an example (usually a program). After all that, there is a handy summary for reference. Advanced command formats and graphics are covered in the next chapter (we wanted to give you a little breathing room).

TAKING CONTROL

Our first set of commands perform functions that can be done either manually or from the printer control panel. Instead,

we can take over and do them automatically -- "from the
software," as computer types would say.

Carriage Return

Carriage return can take place any time we choose.   The code is
13 decimal.

Run this program:

          10 LPRINT "THIS IS THE CARRIAGE RETURN"; CHR$(13);

          20 LPRINT "THIS LINE IS THE SECOND LINE"

Oops! What went wrong? The carriage returned, all right, but
the second line printed right over the first. (See? I knew I
wouldn't understand all this stuff ...) No problem. We just
need the next command. You see, we told the printer to return
the carriage home, but we neglected to tell it to line feed --
that is, to move the paper up a notch. This gives us greater
versatility, as we'll see later. In the meantime we add line
feed. This is ok for TRS-80, but CP/M inserts LF each time a
CR is seen.

Line Feed

Line Feed -- moving the paper up (or down) one line, is code
10 decimal. Modify the program we just did at line 10:

          10 LPRINT "THIS IS THE CARRIAGE RETURN"; CHR$(13);
          CHR$(10);

Run the program and -- ha! This is what we wanted all the time!
But suppose we wanted to print a line, then drop down and print
the next line, without the carriage return? Of course. We
use the line feed command by itself. Line 10 becomes:

          10 LPRINT "THIS IS THE CARRIAGE RETURN"; CHR$(10);

Run this to demonstrate that the Line Feed command is useful on
its own. (Okay, so the printed statement is now incorrect.
Change it.)

Form Feed (Top of Form)

The Top of Form (TOF) pushbutton on the printer advances the
paper one full page length from its present position. Top of
form is a bit misleading for this command since if the paper is
at the middle of the page when the command is received, TOF moves
it to the middle of the next page. (What TOF really does is keep
track of lines printed and the TOF position. The page length
is normally 66 lines.) At any rate, this command does what the
pushbutton accomplishes -- again, at the instruction of the
program. The decimal command is 12. Using it is easy:

```
10 LPRINT "THIS LINE IS ON PAGE ONE"; CHR$(12)

20 LPRINT "THIS LINE IS ON PAGE TWO"
```

Notice that this command contains a carriage return, since the print head returns to the home position. (Don't use on CPM.)

Back Space

Ever wanted to make a slashed zero (∅) or a funny character, but couldn't backspace at will? It's easy with the PROWRITER. The code is 08 decimal. This sequence works in incremental mode:

```
10 LPRINT "THIS IS THE NUMBER 10";CHR$(08);"/"
```
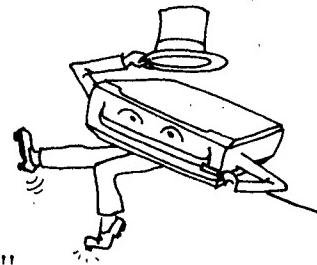
prints the number as 10 -- the printer backspaced for the slash.

We're making great progress! Experiment with these codes for a bit (no pun ...) before continuing.

TAB COMMANDS

Four tab commands make doing letters and other formats a breeze. For two of these commands we introduce variables -- a way to tailor the command to your need. The variable always takes the form of a number that follows the command. There are two ways to write such commands; we'll look at both and you can take your pick. They both do exactly the same thing.

First, let's review two-part commands, called Escape Sequences. This is because the ASCII character is prefaced by the ESCape command. The command takes the form

ESCznn

Where z is the command character. The (decimal) ASCII code for ESC is 27, so that we'd program the command in BASIC as

CHR$(27);"z"

An even more versatile command includes additional numbers to help specify our instructions. It takes the form

CHR$(27);"zmmm"

The last three numbers might be tab positions or repetitions of a character, for example. There is another way to write these commands. Remember that the command character is actually an ASCII character. In a tabbing command (below), the command code 40 is ASCII for the character "(". We could write a command.

CHR$(27);CHR$(40);"325"

or, to do the same thing:

                    CHR$(27); "(325"

This example is not a working command. Let's look at some real
commands -- what we've just said will make more sense as we
use it.

Set Tabs

The Set Tabs command works pretty much like a typewriter's
levers -- you can set tabs at each column you like. The
command takes the decimal form:

                ESC (, a, b, c, ...n.

The numbers a, b, and so forth are the print column numbers for
each tab. They must be three digits long, separated by commas,
and end with a period. (Whew!) Remembering that ESC is ASCII
27, let's set our tabs at 4, 8, and 32 columns across the page:

        10 LPRINT CHR$(27);CHR$(40); "004,008,032."

Or, since ASCII 40 is really "(":

        10 LPRINT CHR$(27); "(004,008,032."

Don't forget the punctuation --
you know how computers are about syntax!
From now on we'll use the first version
of command writing; you can take your pick.
We can't test this command -- or the next one --
just yet. Leave the line of code in the computer for now.
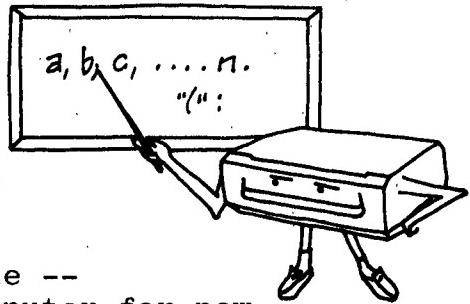
Clear Tabs

If we have a method to set tabs, must there not also exist a
method to clear them? You bet! The command is of the same
form as our Set command, except that it performs the opposite
function:

                ESC), a, b, c, ...n.

Let's clear a tab at print column 8:

        40 LPRINT CHR$(27);CHR$(41); "008."

The same rules apply: the numbers must have three digits, be
separated by commas, and end with a period. We still can't
test the darn thing, but enter line 40 and read on ....

Clear All Tabs

I'll bet your typewriter doesn't have this one. A single command
clears all print column tabs at once:

ESC 0

does the trick.   Let's enter this:

        60 LPRINT CHR$(27);CHR$(48)

There are no extra numbers, since no specific columns must be
designated. (Are you starting to get the hang of this?)

Horizontal Tab

At last! The command that uses all those tabs you've set and
cleared with the other commands. The Horizontal Tab command
sets the carriage to the next valid tab position -- just as
your typewriter does. The command is:

HT

Notice that this is a simple function code -- not an ESCape
sequence like the other tab functions. Add the program lines:

        20 LPRINT CHR$(09); "TAB AT POSITION 4";

        50 LPRINT CHR$(09); CHR$(09); "TAB AT POSITION 32";

        70 LPRINT CHR$(09); "THE TABS ARE GONE!"

LIST to be sure lines 10, 40, and 60 are still in the program,
then RUN.

Notes on TABbing: The column numbers must be three digits long
-- use leading zeros if necessary. They must be separated by
commas and terminated by a period. If you make a mistake when
setting tabs, all tabs are cleared. This also happens if you
try to set more than 33 tabs at one time(!). But, even though all
tabs may appear to be cleared, the printer defaults to tabs set
at increments of eight.

PRINT STYLES

No drab, all-alike printing for your PROWRITER.
You have a wide choice of pitch and text style.
We'll look at each command, a sample program line, and a type
sample. (This is even getting to be fun! And there's more to come.)

CHARACTER PITCH

There are four character pitch commands -- pica, elite, compressed,
and proportional space. When the printer is turned on it will

print either pica or proportional space, depending on the switch settings (Appendix II).

Pica Pitch

Pica pitch is standard for the PROWRITER, as we just noted. It consists of 10 characters per inch (CPI), and the command is

ESC N

Enter this line and print it (Clear any old programs first):

10 LPRINT CHR$(27);CHR$(78); "THIS IS PICA PITCH"

The result will be:

THIS IS PICA PITCH

Elite Pitch

Elite pitch produces 12 characters per inch (CPI). The command is

ESC E

Enter this line:

20 LPRINT CHR$(27);CHR$(69); "THIS IS ELITE PITCH."

This looks like:

THIS IS ELITE PITCH

Compressed Pitch

The availability of goodies like compressed pitch is one thing that separates PROWRITER from its lesser colleagues. Compressed pitch is 17 CPI and the command is:

ESC Q

Our demonstration line is:

30 LPRINT CHR$(27);CHR$(81); "THIS IS COMPRESSED TYPE!"

Pretty clever, huh? RUN 30 should look like this:

THIS IS COMPRESSED TYPE!

Proportional Space

This interesting pitch gives your printouts a snappy,
professional look. Proportional spacing corrects for differences
in character width. The letter I is narrower than the letter
M, for instance. The proportional space function varies
spacing for each character individually. (Is this a classy
machine, or what?) It's easier to see than to describe. The
command is:

ESC P

To see this marvel, type in:

        40 LPRINT CHR$(27);CHR$(80); "PROPORTIONAL SPACING BETWEEN
        CHARACTERS"

RUN 40 and look at the spacing carefully, especially I and O.
Do you see what I mean?

PROPORTIONAL SPACING BETWEEN CHARACTERS

Before we continue, RUN this entire program and compare pitches.
Then experiment -- try changing pitches on the same line. You
can even do it within the same word (don't forget to use
semicolons).

SPECIAL TEXT

Here are commands usually associated with special-print
functions: elongated characters, boldface, underline, and
character repeat. We now introduce a new concept: The
Persistent Command. This command is like a switch -- when
you turn it on it keeps doing its thing until you turn it off.
Thus, all of the commands in this group (except character
repeat) are really two commands: one to begin the print
activity, the other to stop it.

Elongated Characters -- Select/Clear

The elongated-characters command produces double-width print.
Turn it on with the function code

SO

Delete the old program and try this line:

        10 LPRINT CHR$(14); "ELONGATED TYPE IS QUITE USEFUL!"

It will look like this:

ELONGATED TYPE IS QUITE USEFUL!

Turn this function off with the function code

<p align="center">SI</p>

Use this code to clear the text before continuing.

<p align="center">LPRINT CHR$(15)</p>

Boldfaced Type -- Select/Clear

Your PROWRITER produces dark, clean boldface type. Turn it on
with the ESCape sequence

<p align="center">ESC !</p>

Run this sample line:

        10 LPRINT CHR$(27);CHR$(33); "THIS IS BOLDFACE TYPE"

It looks like ... well, boldface!

<p align="center">**THIS IS BOLDFACE TYPE**</p>

Turn off (clear) boldface with the ESCape sequence

<p align="center">ESC "</p>

Clear the boldface function before continuing.

<p align="center">LPRINT CHR$(27);CHR$(34)</p>

Text Underline -- Select/Clear

Ah -- another traditional text option. Set underline with the
ESCape sequence

<p align="center">ESC X</p>

Run this line:

        10 LPRINT CHR$(27);CHR$(88); "SEE -- IT REALLY IS UNDERLINED!"

It looks like

<p align="center"><u>SEE -- IT REALLY IS UNDERLINED!</u></p>

Clear underlined text with the ESCape sequence ESC Y

<p align="center">LPRINT CHR$(27);CHR$(89)</p>

By the way, feel free to substitute more imaginative printed
sentences for the dull examples I've given!

Character Repeat

Character Repeat differs from the other commands
in this group in that it doesn't have to be
turned on and off. By its very nature, it does
its thing and goes away. What it does do is
simple and effective: It causes the next printed
character to be repeated as many times as you like
(up to 999!). It's useful for printer header lines like this:

****
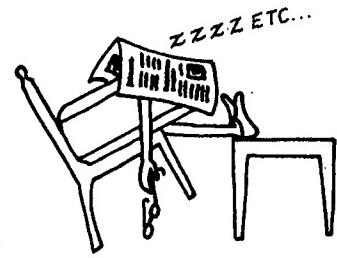
It's related to the BASIC command STRING$, which does the same
thing on a more limited basis. The command format is

                    ESC R, nnn

where nnn is the number of times the next character will be
repeated.

It must be three digits. RUN the line

        10 LPRINT CHR$(27);CHR$(82); "080" "$"

This produces

$$

More than one Special Text command can be included on a line,
or even in a word (using semicolons to avoid extra spaces).
Experiment with using more than one at a time -- bold underline,
and so forth. Then we'll customize your page layouts.

PAGE FORMATTING

Different strokes for different folks includes keystrokes, too --
as well as page formatting. PROWRITER permits you to custom-set
your line feed size (the spacing between each printed line),
reverse the line-feed (run the paper the other way), and select
unidirectional or bidirectional print. You can also set and
reset the left margin at any time.

Quite a selection! We'll look at the commands in three groups:
Line Feed, Margin Set, and Print Direction.

Line Feed Commands

Three commands set the spacing between lines. The first two
are fixed, the third is customized. We'll describe all three,
then give an example.

        Line Feed 1/6 inch: This is the spacing when the printer

is turned on. Reset to this spacing with

ESC A

Line Feed 1/8 inch: For tighter spacing, use this command

ESC B

Custom Line Feed: This command lets you select your own
spacing, based on nn/144. For example, setting nn=12
in the command results in a line spacing of 1/12 inch.
(Try that on many printers.) The command format is

ESC T,nn

Run this example:

```
10 LPRINT "THIS IS LINE FEED 1/6 INCH, WHICH IS
STANDARD."

20 LPRINT "WE NEED THIS LINE TO DEMONSTRATE!"

30 LPRINT CHR$(27);CHR$(66); "HERE IS 1/8 INCH FEED."

40 LPRINT CHR$(27);CHR$(84); "72"; "HERE IS 1/2
INCH CUSTOM."

50 LPRINT "THIS IS ANOTHER FILLER LINE"; CHR$(27);
CHR$(65)

60 LPRINT "NOW WE'RE BACK IN 1/6-INCH PITCH."
```

Do you see that the command affects spacing on the next line?
Experiment, then -- onward!

Forward and Reverse Line Feed

Forward line feed is what the printer does normally --
in fact, that's all you get with most printers. To
reverse the line feed at any time; that is, to move the
paper in the opposite direction, use the ESCape sequence

ESC r

To make things "normal" again, use

ESC f

You can see this sequence in action with this funny little
program:

```
10 FOR N=1 TO 50

20 LPRINT CHR$(10);CHR$(27);CHR$(82); "080*"

30 NEXT
```
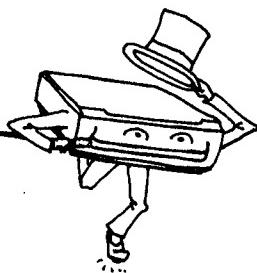
```
40 LPRINT CHR$(27); CHR$(114)

50 GOTO 10
```

This program prints a field of asterisks one way, then goes
back and does it in reverse. Note the use of the character
repeat command ESC R, nnn.

Print Direction

PROWRITER wakes up wanting to print bidirectionally, saving
time and energy. You can make it print in only one direction
(forward) by using the command

ESC >

CHR$(27); CHR$(62)

Clear this command (go back to bidirectional print) with

ESC <

CHR$(27); CHR$(60)

Left Margin Set

Last -- but an important feature -- is the command to set the
left margin. It is

ESC L, nnn

CHR$(27); CHR$(76)

where nnn is the column number you want. The margin will stay
put at that position until you change it.

WHEW!

Bet you didn't know you -- or the PROWRITER -- had it in you!
As you can see, the possibilities and combinations are endless.
In the next chapter we'll introduce some advanced techniques.

There's a table of all printer commands in Appendix V.

CHAPTER FOUR: The Versatile Printer

Your PROWRITER is like an orchestra --
and you now hold the baton.
But there's still more. In this
chapter we'll examine additional
print functions, vertical formatting,
and bit image graphics. You'll find
that they round out your printer
education, and perform some tricks
that will knock your eyes out!
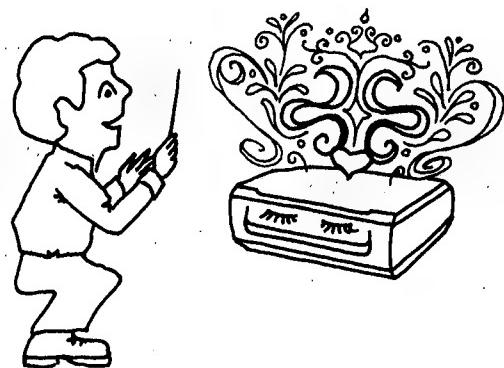
CHARACTER SET SELECTION

PROWRITER provides foreign-language character sets. These sets
are selected by the switches as described in Appendix II. In
addition, you can select Greek characters or graphic symbols
by using ESCape sequences. Tables of available symbols are
shown in Appendix III.

Greek Characters

Math and other material is easy on the PROWRITER. Use the command

                    ESC &
              ESC & CHR$(27); CHR$(38)

to produce the Greek alphabet.

Graphic Symbols

Enter the Graphic Symbol mode -- again, for math and other
material -- by using

                    ESC #
              ESC # CHR$(27); CHR$(35)

This character set is quite effective when used with the
Character Repeat command (described in Chapter Three) for
special effects.

Alphanumeric Characters

It's back to the ASCII family of familiar faces again -- after
venturing forth into exotic territory, use

ESC $

ESC $ CHR$(27); CHR$(36)

to return to normal. (Normal, that is, if you don't read Greek.)

INCREMENTAL AND LOGIC SEEK PRINT MODES

In incremental print mode the PROWRITER prints each character
as it is received from the computer. Any carriage-return command
causes the print head to move to the left home position. In
logic seek mode, print characters are stored in a buffer until
either a print command (such as carriage return) is received or
an entire line of data has been received. In logic seek mode
printing is bidirectional and the print head moves with uniform
high speed. Logic seek mode is the normal print mode, but you
can switch to incremental mode and back with these commands:

        ESC [places the printer into incremental print mode
            CHR$(27); CHR$(91)

        ESC] returns the printer to logic seek mode.
            CHR$(27); CHR$(93)

DOT-BY-DOT PROGRAMMING

As though all the character programming PROWRITER offers weren't
enough ... yikes! You can program this thing by the dot! You
bet. In this section we'll see how to perform: dot-by-dot
spacing, dot column repeat, and dot addressing.

Dot-by-Dot Spacing

With PROWRITER in proportional-space mode (Chapter Three),
you can select any desired spacing between characters. This
spacing is given in terms of dots. From one to six dot spaces
can be programmed, and by repeating the command you can get up
to 128 dot spaces. There are six ESCape sequences, one each for
up to six dot spaces:

        ESC 1 = 1 dot space

        ESC 2 = 2 dot space

        ESC 3 = 3 dot space

```
              ESC 4 = 4 dot space

              ESC 5 = 5 dot space

              ESC 6 = 6 dot space
```

Remember -- dot spacing works only in the proportional space
mode. It looks like this:

                    ]SIX DOTSPACING

Dot Column Repeat

This command repeats the next byte received on the program line
nnnn times in eight dots per dot column:

                    ESC V, nnnn

                 CHR$(27); CHR$(86)
                 ]DOT COLUMN REPEAT══════0

Dot Addressing

The PROWRITER permits you to move the carriage to any position
you like -- even the exact dot position. To do this, a print
line is divided up into N dot spaces. The number of dot spaces
per line is different for each pitch, as we see below. To
position the carriage "on the dot" (sorry), use this ESCape
sequence:

                    ESC F, nnnn

                 CHR$(27); CHR$(70)

where nnnn is the dot position you'd like. Here is the maximum
number of dots per line for each available pitch:

     Pica (10 cpi)   640 dots maximum

     Proportional   1280 dots maximum

     Condensed (17 cpi)   1088 dots maximum

     Elite (12 cpi)   768 dots maximum

Dot's it. Use these commands for precise printing positioning
or for graphics. Speaking of graphics, look at this ....

BIT IMAGE GRAPHICS

The Basics

PROWRITER offers outstanding graphics capability. Special
commands enable you to specify (in the program) which wires
of the dot head will be fired in any dot position. Full-page,
high-resolution graphics can be printed, since you actually

                              4-3

control every dot the PROWRITER prints. If that gives you a
feeling of power -- well, enjoy it! And read on.

Your computer organizes print information in such a way that
every vertical column of dots printed can be represented by a
unit of information called a BYTE (sound familiar?). Remember
from Chapter Two that the print head prints one column of dots
at a time.

Further, each byte contains either seven or eight BITS of
information. We'll assume seven bits from now on to keep
things simple. Okay -- EACH BIT REPRESENTS ONE DOT. Got that?
Also -- bit information is arranged in a vertical column con-
sisting of one byte, with the least-significant bit (LSB) at the
top and the most-significant bit (MSB) at the bottom. Don't
worry about the least- and most-significant business: it just
tells us in which order the information is processed.

A typical dot pattern is organized into bits and bytes like
this:

```
LSB  ●   ●   ●   ●   ○   ○   ●   ●
     ●   ○   ●   ○   ○   ○   ●   ○
     ●   ●   ○   ○   ●   ○   ○   ●
     ●   ○   ○   ○   ○   ○   ●   ○
     ●   ○   ●   ○   ○   ○   ●   ●
     ●   ●   ○   ●   ○   ○   ○   ●
     ●   ○   ●   ●   ○   ○   ●   ○
MSB  ○   ○   ○   ○   ○   ○   ○   ○
    127  37  83  97   4   Ø  91  53
```

All right, listen closely: this might take a bit of head-
scratching but don't continue until it's clear. Otherwise
your ability to create graphics will be limited, your life a
shambles.

First, look at the column of numbers on the right of the dot
drawing -- the one with LSB and MSB at the top and bottom.
Each number in this column is a power of 2. It identifies the
bit position in the column. TO TELL THE COMPUTER WHICH DOTS TO
TURN ON IN EACH COLUMN, ADD THE POWER-OF-TWO COLUMN NUMBERS OF
THE DOTS TO BE TURNED ON.

For example, in the second column, the dots corresponding to
column positions 1, 4, and 32 have been turned on. The sum
of these numbers, 37, is shown at the bottom of the column. THE
NUMBER 37 IS UNIQUE AND INDICATES THE FIRST, THIRD, AND FIFTH
BITS OR DOT POSITIONS. No other number will describe these
positions. This won't sound true at first, so fiddle around
with the numbers to convince yourself before you continue.
These column sums are the data we'll use to set up our graphics.

(Note: We've left the lowest, MSB row blank in this example
since we're assuming a seven-bit code.)

Now we have a way to identify each dot the printer prints.
An interesting and useless piece of information unless we also
know how to tell the printer to print pattern!

SELECTING DOT GRAPHICS MODE

Select graphics mode on the PROWRITER by using the command

ESC S n1 n2 n3 n4

Here, n1 n2 n3 n4 is a four-digit number which designates the
number of bytes (dot columns) to be printed in graphics mode.
So the command does two things: first, it tells the printer that
the graphics mode is coming; second, it makes a reservation in
memory for the size of the graphics block expected.

EXAMPLE: ESC S 0025 sets up the graphics mode and reserves space
for 25 bytes (dot columns). Expressed in the familiar BASIC
form, the command looks a bit more friendly:

        CHR$(27);CHR$(83);"0025"

Decimal 83 is the ASCII equivalent of the letter S.

PUTTING IT TOGETHER

We now know how to represent each dot-column setup with a
unique number, how to tell PROWRITER that a graphics block is
coming, and how to reserve space for it. Actually writing a
BASIC program to produce bit-image graphics involves inter-
grating these two steps:

    o   Write a statement to set up graphics mode and reserve
        the space

    o   Place the column numbers into a DATA statement

    o   Set up a loop to READ the data.

Let's do this for the pattern in our example above:

        10 LPRINT CHR$(27);CHR$(83);"0007";

        20 FOR I = 1 TO 7

        30 READ B:LPRINT CHR$(B);

        40 NEXT I

        50 LPRINT

        60 DATA 127, 37, 83, 97, 4, 0, 91

Not much of a pattern, and it only prints once. To have the
pattern repeat N times put another loop around the read loop,
with a RESTORE statement to reset the data pointer. We'll do
this in our next example.

OUR NEXT EXAMPLE

This will help you get the hang of doing your own graphics.
If you're rusty on BASIC READ statements and FOR-NEXT loops,
review them now.

Everybody draws "smile" faces. Let's be different and make one
that frowns. Set it up in grid form, like this:

```
        1 2 3 4 5 6 7 8 9 10
      1                          1
      2     ██ ██     ██ ██      2
      4     ██ ██     ██ ██      4
      8                          8
     16     ██ ██ ██ ██ ██      16
     32  ██ ██ ██ ██ ██ ██      32
     64  ██ ██           ██ ██  64
        1 2 3 4 5 6 7 8 9 10
```
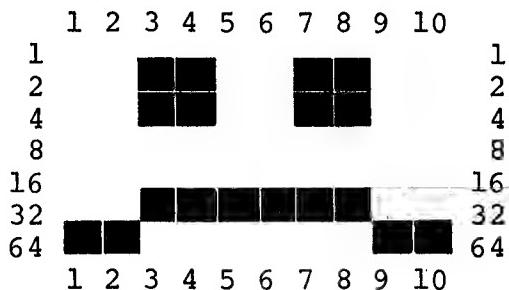
The program is:

        10 FOR X=1 TO 20

        20 LPRINT CHR$(27);CHR$(83); "0010";

        30 FOR I=1 TO 10

        40 READ B: LPRINT CHR$(B);

        50 NEXT I

        60 RESTORE

        70 NEXT X

        80 LPRINT

        90 DATA 64, 64, 35, 35, 32, 32, 35, 35, 64, 64

The I-loop prints one complete face. The X-loop provides 20
repetitions; the RESTORE statement tells the READ statement to
start at the beginning of the DATA again. Here's the little
dickens:

The possibilities are limitless. Play to your heart's content --
two easy assignments are: make the frown into a smile, and give
the face a nose. If you can do these things you probably under-
stand bit-image graphics pretty well.

GRAPHICS DENSITY

The density of the graphics on the page is determined by the

pitch selected.   Here is the dot density for the available
pitches:

PITCH	DOTS PER INCH	DOTS PER LINE
Pica - 10 cpi	80	640
Elite - 12 cpi	96	768
Compressed - 17 cpi	136	1088
Proportional	160	1280

LINE SPACING

Use programmable line spacing (Chapter Three) to set the space
between graphics lines.

VERTICAL TAB FORMATS

You can customize your printer for vertical tabs -- automatic
line skips and stops -- to make multi-part forms easy to print.
Vertical tabs are a lot like horizontal tabs, except that the
printer skips over vertical lines instead of horizontal spaces
to stop at predetermined lines.

For example, suppose you have a form on which data is to be
printed on line 7, followed by 10 pre-printed lines.   Then
data must be printed on line 11 -- and so on.   Impossible on
most printers!

EVFU

The Electronic Vertical Format Unit (EVFU) permits you to set
up a variety of predetermined vertical tabs.   Up to six forms
can be programmed with individual vertical tab stops.   The
tab information for each form is stored in a Channel, and re-
ferred to when that form is to be used.   Top of Form (TOF) and
Bottom of Form (BOF) can be altered to suit different form
sizes.

How It Works

The printer enters EVFU mode when it receives a specific command
from the host computer.   Each channel is then programmed with
the desired vertical tabs using groups of binary information, and
the EVFU sequence is ended with another command.   The printer
is then ready to print forms with the proper vertical spacing.
It stays in this mode until it's reset.

Be Practical!

Enough of this high-minded information -- how do I use it?

That's the spirit. Loading the EVFU by hand can be quite
tedious, so we've provided a program that automatically pro-
grams the tabs you select. I suggest you enter the program
now and save it to tape or disk -- then you'll have it when it's
needed.

The program is configured for TRS-80 computers. For others,
be sure to make the minor changes in syntax required when
going from one form of BASIC to another. In particular, if
you've got an Apple computer you'll have to change all the
LPRINT statements to PRINT statements and bracket them with
PR#1 and PR#0 statements.

                          EVFU PROGRAM

```
10 / ELECTRONIC VERTICAL FORMAT UNIT (EVFU) PROGRAM
20 / A SIMPLE PROGRAM TO SET THE PAGE LENGTH AND PERFORATION
30 /    SKIP ON A PROWRITER (8510A) PRINTER
40 CLEAR 300
50 / CHANGE 66 TO 72 TO REFLECT SETTING OF DIP SWITCH 1-4
60 INPUT "TYPE THE NUMBER OF LINES PER PAGE (2-66) ";L
70 IF L>66 OR L<2 THEN 60
80 INPUT "TYPE THE NUMBER OF LINES TO SKIP AT PERF.";S
90 IF L-S<2 THEN 60
100 X$=CHR$(29)              / START EVFU PROGRAM
110 X$=X$+"A@"               / MARK TOP OF PAGE 1
120 IF L-S<3 THEN 160
130 FOR I=1 TO L-S-2
140      X$=X$+"@@"          / MARK EACH PRINTABLE LINE
150 NEXT I
160 X$=X$+"C@"               / MARK BOTTOM OF PAGE
170 IF S=0 THEN 210
180 FOR I=1 TO S
190      X$=X$+"@@"          / MARK EACH LINE TO SKIP
200 NEXT I
210 X$=X$+"A@"               / MARK TOP OF PAGE 2
220 X$=X$+CHR$(30)           / END EVFU PROGRAM
230 LPRINT X$;
240 INPUT "ALIGN PRINTER TO TOP PRINTABLE LINE NOW ";X$
250 CMD"S
```

CHAPTER FIVE: How It Works

GENERAL

The PROWRITER is a dot-matrix device employing a 7 x 9 wire-matrix and solenoid-driven printhead. A stepping motor provides full mechanical functions from either the printer panel or host computer software.

o

PROWRITER is microprocessor-based. The 8085, 8-bit CPU controls data processing and flow by means of an eight-bit data bus and a sixteen-bit address bus.

o

Local RAM and ROM are provided. ROM contains printer commands; RAM contains a temporary storage area that functions as the printer text buffer.

o

Additional CPU control is provided through the use of internal DIP switches.

o

PROWRITER I/O interface receives print and control data from the host computer. An eight-bit parallel interface is standard, while a serial interface is available as an option.

o

An internal sensor interface loads sensor-detecting signals such as PAPER EMPTY on the data bus for action by the CPU. The operation panel interface loads the status of the panel switches.

o

CPU/TTL reset circuitry initializes the CPU and TTL devices when power is applied. Power is supplied to the printer electronics by a +5v, regulated supply in the Printer Control Unit.

OPERATION

A block diagram of the printer logic is provided on the next
page.

CPU

The 8085 CPU functions as an 8-bit parallel data processor.
Low-order addresses share the address bus line with data
pulses, requiring a latch for these addresses.

The printer program is stored in ROM and is fetched by the
8085 one step at a time. Commands are executed within the
prescribed machine cycle. The program consists of

       o   Fetching print data from RAM buffers and sending it
           to the print-head drivers

       o   Detecting print-command data and executing those
           commands

       o   Responding to signal data from internal sensors.

CPU execution of its program functions depends upon the settings
of the internal DIP switches.

Memory

Printer memory consists of L2732 ROM and 2016 RAM. RAM is used
as local storage and as a text buffer for data I/O. The printer
program is stored in two 4K ROMS (8K total); printer character
patterns are stored in a single 4K ROM. A total of 3K RAM
is available. Data is fetched by the CPU from each memory
portion as called for by the program.

Internal DIP switch positions effectively hard-wire commands
into the CPU. These switch positions (and the resulting
commands) take precedence over software command strings.

I/O Interface

The I/O interface is an I8255. The interface circuit receives
print and control data from the host computer and latches this
data to either I/O ports or a flip-flop. The data is trans-
mitted to the CPU through a buffer. This interface also latches
the status signals SELECT, BUSY, PE, which are output from the
CPU to the I/O port and sent out through a transceiver.

Internal Sensor Interface

The internal sensor interface uses as LS 257. The interface
loads sensor-detecting signals such as LEFT POSITION, RIGHT

POSITION, PAPER EMPTY, and INTERLOCK on the data bus, keeping
the CPU informed of printer status. The operation panel inter-
face loads the status of switches SELECT, TOF, and LF onto
the data bus.

Left carriage position is detected with photocells; the paper
empty detector is a microswitch. Right carriage position and
cover open signals are also switch-based.

Initial Reset

The initial reset circuit initializes the CPU and TTL
circuitry at turn-on, and is basically a comparator/regulator.
When ac power is turned off the circuit stops operation of
the printer while IC operation is still stable -- that is, before
the 5v begins to drop.
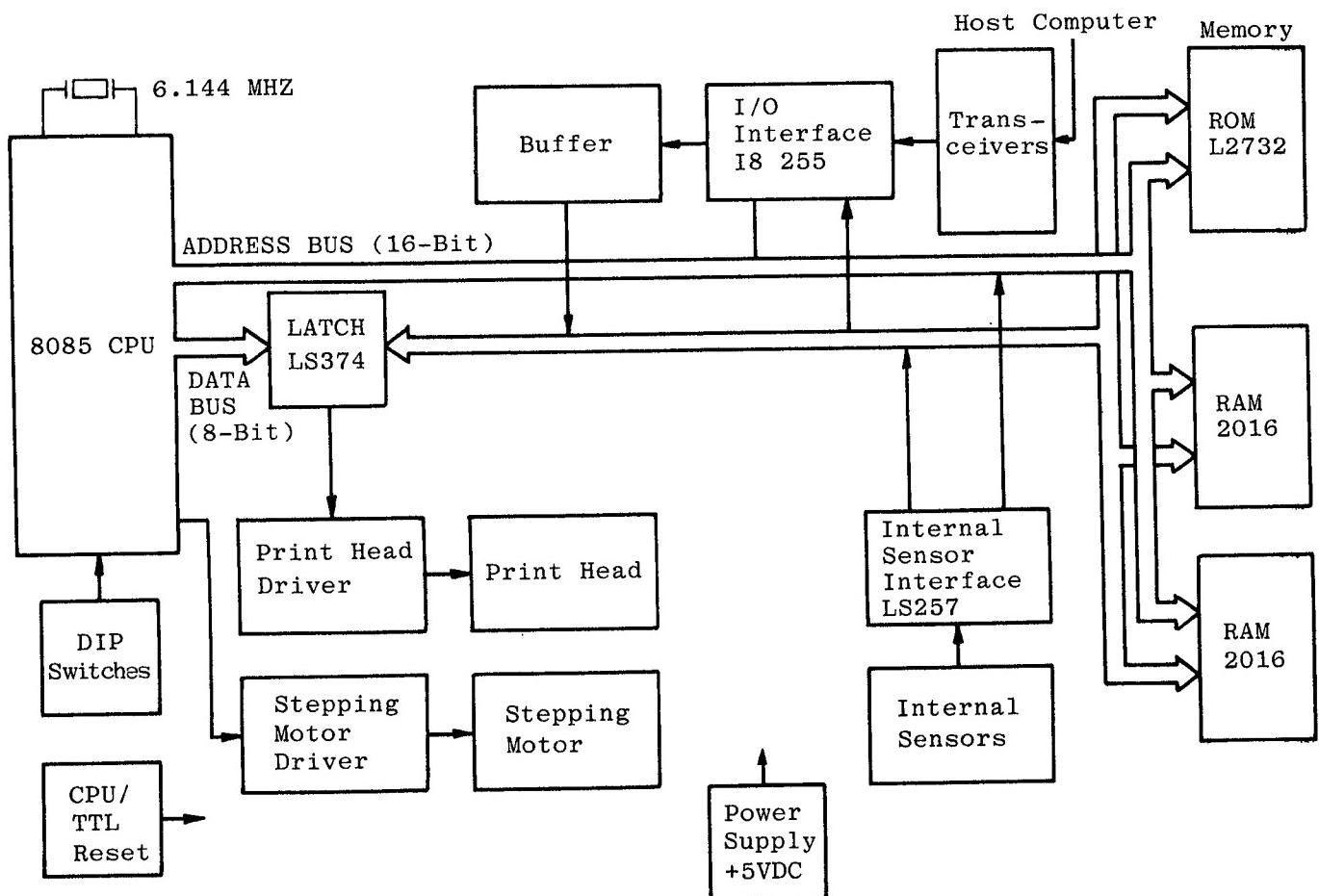
Dot Wire and Motor Drive Interfaces

When driving a dot wire the CPU latches the print pattern to an LS 374 D-type latch. At the same time, a strobe is generated and outputs the dot-enable signal. The presence of both the print pattern and the strobe in the latch circuit fires a one-shot multi-vibrator, activating the dot solenoid.

To drive the carriage movement and stepping motors, the CPU latches their phase excitation patterns. Then, when a motor-movement command is received, the corresponding phase-excitation pattern is altered, changing the phase of the drive voltage and moving the motor the required amount.

Power Supply

Power for the solid-state components is provided by a +5 volt dc, regulated supply. Extensive ac filtering is employed in a full-wave bridge circuit.

CHAPTER SIX: Keeping the Wheels Turning

Maintenance

Your PROWRITER is a rugged, dependable electronic
device that will provide years of service.
Following the general guidelines we give here,
and performing periodic maintenance and adjustment
will keep your printer feeling chipper indefinitely.
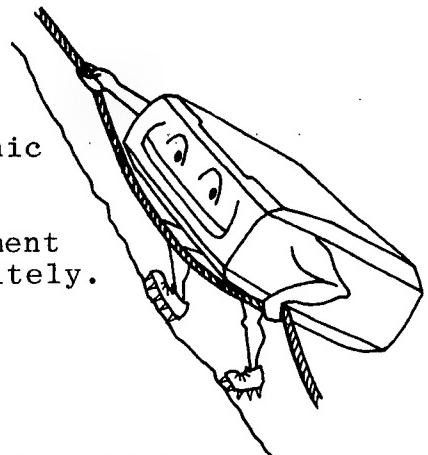
GENERAL OPERATING GUIDELINES

Here are the operating practices that help avoid problems:

o   NEVER print without a ribbon -- doing so can damage the
    print head

o   Don't print without paper. This marks the platen,
    making its surface uneven

o   Use only the correct ribbon type, and replace it when
    it becomes worn. Don't put off ribbon replacement!

o   NEVER place foreign objects inside the printer while
    it is printing. Your fingers are foreign objects!

o   NEVER pull on the paper while the printer is printing.
    Moving the paper while printing will damage the print
    head.

CLEANING

Clean your printer:

o   When you notice that ribbon chips, dust, or other
    foreign matter has accumulated either on the detector
    or the end of the printing head

o   Every year or every 500,000 lines of printing.

Cleaning Guidelines:

     o When cleaning, don't remove any printer parts
        except the ribbon

     o Don't use detergents or solvents, such as benzines,
        when cleaning. They can dissolve plastic parts

     o The cover should be cleaned using a soft cloth
        dampened with water or weak liquid soap.

Cleaning the Detector and Head Top

Clean the detector by brushing off dust
from on and around it:

Next, clean the head top. In particular,
brush off dust and ribbon chips from the
head end. Never bend or force the
printing head.

Head top

Platen
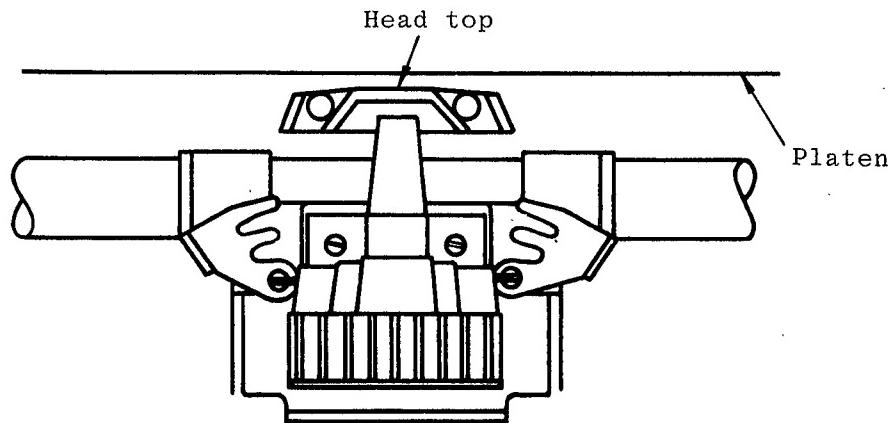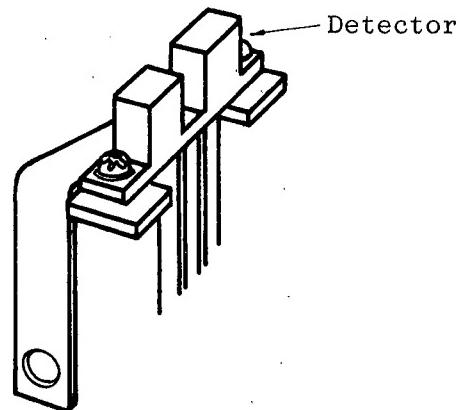
LUBRICATION

For best performance, lubricate your printer every year or
every 500,000 printing lines. Use light machine oil, and
lubricate only the points shown here.

     o Using gauze or cotton, wipe
        off any dirt from the
        carrier shaft and the
        carrier guide shaft

Lubrication ring

     o Apply a small amount of
        light machine oil to the
        lubrication ring:

Carrier shaft

Detector
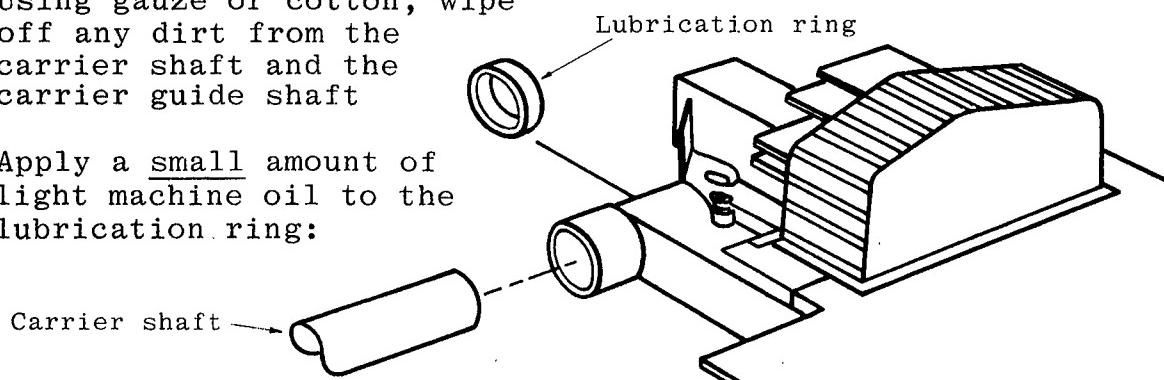
ADJUSTMENTS

Several printer adjustments can be made to tailor
printing to your specific needs.
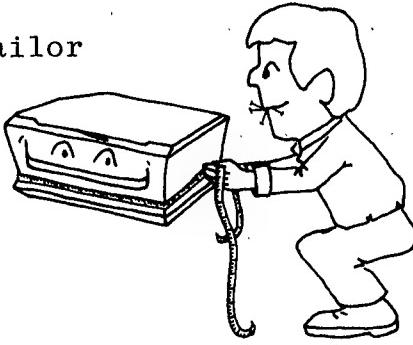
Print Line Adjustment

The point at which the first line of print
appears on the paper can be adjusted easily.

     o Use SEL to bring the printer off line

     o Press TOF, bringing the paper to the top-of-form
        position

     o Turn the right platen knob to adjust the first print
        line to the position you want.

This procedure sets top-of-form. LF only advances the paper;
it does not affect top-of-form.

Dot Head to Platen Gap

The printer head position has been adjusted to print one or
two copies at a time. To increase the gap to print up to four
copies shift the head-adjustment lever toward you as shown.
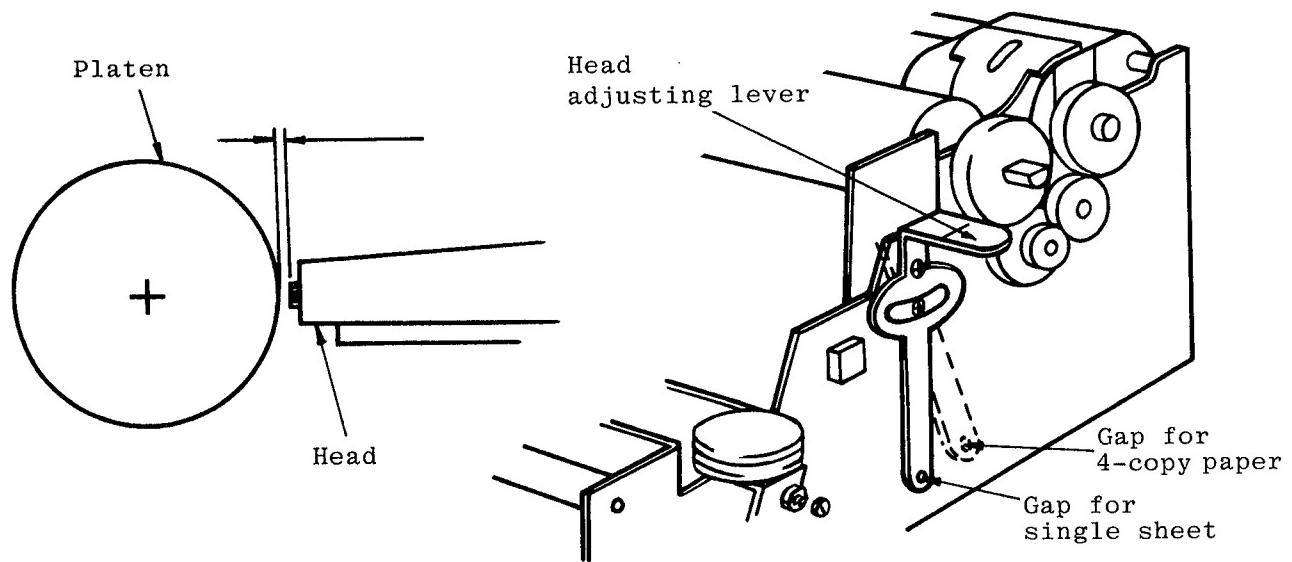
Impact and Alignment Adjustments

Print pressure and alignment can be adjusted using the two
controls just to the left of switches SW1 and SW2 inside the
front right chassis. (They are shown in the switch illustration
in Appendix II.)

Use an insulated screwdriver to adjust each control. Make a
small adjustment, then run a print sample.

DON'T FORGET ...

Don't forget to say a few kind words to your printer now and
then. It works hard and deserves them.

CHAPTER SEVEN: When Things Go Wrong

Troubleshooting

It's not that your company representatives don't
enjoy hearing from you! But many apparent printer
problems are curable by you -- simply, and quickly.
This saves you time, energy, and money. So: if a
problem crops up, go through this chapter before
you call your company service representative.
By the same token -- if the problem isn't
easily cured, don't hesitate to call.
DON'T ATTEMPT TO SERVICE THE PRINTER
YOURSELF. Call your Tech Rep at
Leading Edge: 1-800-343-6857 --
that's what he's there for.
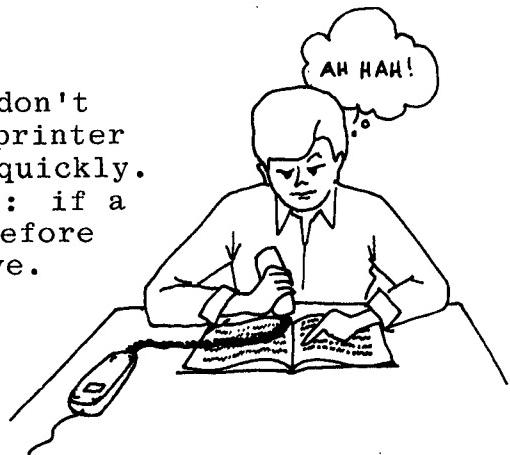
A FEW TROUBLES TO SHOOT

Here are the most common problems encountered by users:

o PRINTER WILL NOT PRINT

    -- Is the ac power cord plugged into an outlet
       (110v, 60Hz)? Is the outlet "live?"

    -- Locate the fuse on the rear panel. Remove it and
       test for open circuit.

    -- Is the printer on line (SEL light lit)?

    -- Are you out of paper?

    -- Is the cover open?

    -- Are the computer connections to the printer correct?
       Check, especially, the interface cable..

    -- Are the DIP switch settings for the printer and host
       computer set correctly? See Appendix I for settings.

o PRINTER PRINTS GARBAGE

    -- Tighten or replace interface cable

    -- Wrong character set -- check DIP switch settings
        (Appendix I).

o PAPER JAMS, FEED IS CROOKED

    -- Feed pins not in paper holes (check each side)

    -- Both sprockets not closed over pins

    -- Paper is sticking or feed obstructed -- check all
        paper flow, from paper box through printer.

o PRINT IS LIGHT

    -- Adjust impression control (See Chapter Six)

    -- Ribbon is worn out

    -- Ribbon feed is jammed

    -- Gap adjustment is incorrect (See Chapter Six).

o CHARACTERS ARE MISALIGNED

    -- Adjust alignment control (See Chapter Six)

    -- Paper and sprockets loose or misaligned.

o TOP OF FORM (TOF) AND LINE FEED (LF) FRONT-PANEL FUNCTIONS
   WON'T WORK

    -- These functions won't work unless the printer is
        deselected.

APPENDIX I: Computer Interfacing

INTRODUCTION

One of the nice things about your PROWRITER is its sense of
deomcracy: it will strut its stuff with most any computer on
(or off) the market. To get it to perform, however, you must
interface (fancy word for "connect") it to your particular
computer.

Each computer is slightly different, so we've described inter-
facing for five popular computers. Other computers will inter-
face in a similar manner; refer to your computer manual.

CABLING

You must use an interface cable to connect the printer to
your computer. (If you find a way to do it without a connection
write to me; we'll make a fortune.) Connect the cable for
either parallel or serial interface to the appropriate connector
on the rear of the printer:

3-pin female
ac power connector

Parallel interface
36-pin connector

Serial interface
25-pin connector (option)
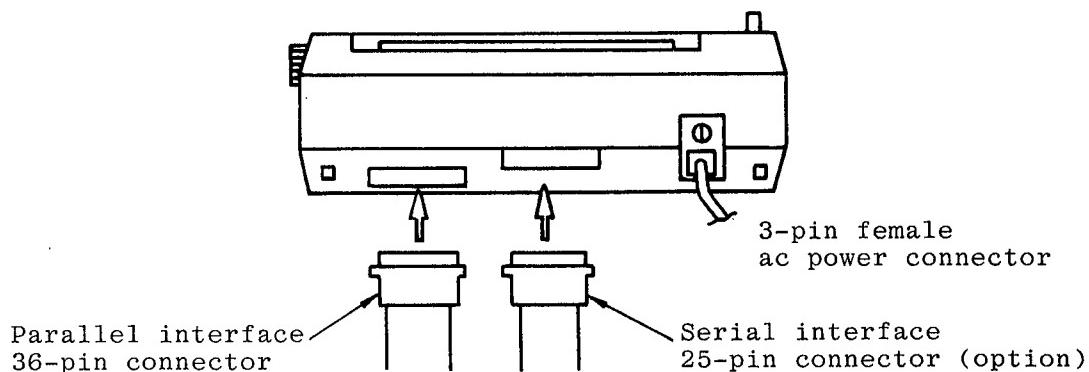
Connect the other end to your computer or computer system as
described in your computer manual.

In this Appendix we've included the relevant pin connections
for the most common cables. An asterisk (*) beside the cable
designation means that it's available from Leading Edge
Products, Inc.

SWITCH SETTINGS

The second item on our interconnection list is DIP switches.
DIP switches in general, and each switch that changes a printer
function (as opposed to those that are purely technical) are
described in Appendix II. This Appendix lists the switch set-
tings necessary to run the printer for each computer. Switch

locations are shown in Appendix II, too. If a switch is not
mentioned, use the factory settings!

Information of interest to technical types is given after the
switch settings.

NOTE

Switch setting tables use X = closed, O = open.

PROWRITER TYPES

There are two types of PROWRITERS: A serial version and a
parallel version. Be sure to use the cable and switch
settings for your model.

NOTE

If you aren't familiar with DIP switches read Appendix
II (just the first part) before you continue.

WARNING

Perform all cable connections, switch settings, and
other adjustments with power off and both printer and
computer system unplugged. Otherwise damage to the
equipment and personal injury may result. Refer any
problems to competent service personnel.

Switch Settings 8510AP/1550P

SW1   SW2

<u>1 2 3 4 5 6 7 8</u>   <u>1 2 3 4 5 6 7 8</u>
O X O O O O O O   O O O O O O O O

*Cabling

PARALLEL INTERFACE: 36-pin Amphenol to DB25:

```
1-----------------------1          19----------------------
2-----------------------2          20----------------------18
3-----------------------3          21----------------------19
4-----------------------4          22----------------------20
5-----------------------5          23----------------------21
6-----------------------6          24----------------------22
7-----------------------7          25----------------------23
8-----------------------8          26----------------------24
9-----------------------9          27----------------------25
10----------------------10         28----------------------
11----------------------11         29----------------------
12----------------------12         30----------------------
13----------------------13         31----------------------16
14----------------------           32----------------------15
15----------------------           33----------------------
16----------------------           34----------------------
17----------------------           35----------------------
18----------------------           36----------------------
```

APPLE II and APPLE II PLUS

Switch Settings -- 8510AP/1550P

SW1   SW2

```
1 2 3 4 5 6 7 8                                  1 2 3 4 5 6 7 8
O X O O O X X X                                  O O O O O X X O
```

Switch Settings -- 8510ACD/1550CD

SW1, SW2:   same as 8510AP/1550P

SW21   SW22

```
1 2 3 4 5 6 7 8                                  1 2 3 4
O O O X O O O O                                  O X X O
```

SW23   SW24

```
1 2 3 4 5 6                                      1 2 3 4 5 6 7 8
X O O O X O                                      X O X O X O O X
```

BAUD RATE = 1200
NO PARITY
CHARACTER LENGTH = 8 BIT
1 STOP BIT

*Cabling

PARALLEL INTERFACE: Depends on printer interface used.

SERIAL INTERFACE: Depends on printer interface used. The
most commonly-used configurations are:

For APPLE interface cards.

```
Printer --------- Interface
   1                 1
   3                 3
   7                 7
   20                20
```

For CCS 7710A card.

```
Printer --------- Interface
   1                 1
   3                 3
   7                 7
   20                4
```

OSBORNE

This information also applies to most CP/M interfaces.

Switch Settings -- 8510AP/1550P

SW1   SW2

1	2	3	4	5	6	7	8		1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---		---	---	---	---	---	---	---	---
O	X	O	O	O	O	O	O		O	O	O	O	O	O	O	O

Switch Settings -- 8510ACD/1550CD

SW1, SW2:   same as 8510AP/1550P

SW21   SW22

1	2	3	4	5	6	7	8		1	2	3	4
---	---	---	---	---	---	---	---		---	---	---	---
X	O	O	X	O	O	O	O		O	X	X	O

SW23   SW24

1	2	3	4	5	6		1	2	3	4	5	6	7	8
---	---	---	---	---	---		---	---	---	---	---	---	---	---
X	O	O	O	X	O		X	O	O	X	X	O	O	X

BAUD RATE = 1200
NO PARITY
CHARACTER LENGTH = 8 BIT
1 STOP BIT

*Cabling

PARALLEL INTERFACE:

IEEE	36-pin	
1	2	data 0
2	6	data 4
3	3	data 1
4	7	data 5
5	4	data 2
6	8	data 6
7	5	data 3
8	9	data 7
11	1	strobe
12	19	ground
15	11	busy
16	29	ground
19	13	select

SERIAL INTERFACE:

Printer	Osborne
1	1
3	3
7	7
20	20

A1-5

ATARI 800 AND 400

Switch Settings -- 8510AP/1550P

SW1

1	2	3	4	5	6	7	8
O	X	O	O	O	X	X	X

SW2

1	2	3	4	5	6	7	8
X	O	O	O	O	O	X	O

*Cabling

PARALLEL INTERFACE:

DB15	36-pin	
1	1	data strobe
2	2	data 1
3	3	data 2
4	4	data 3
5	5	data 4
6	6	data 5
7	7	data 6
8	8	data 7
11	14	
12	32	fault
13	11	busy
15	9	data 8

TRS-80 MODELS I, II, AND III

Switch Settings -- 8510AP/1550P

SW1   SW2

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8
O X O O O X X   X X O O O O X O

*Cabling

PARALLEL INTERFACE: MODEL I AND III: Use 34-pin edge card
to 36-pin.

PARALLEL INTERFACE: MODEL II: Use 34-pin header to 36-pin.
Wire straight through pins 1 - 17, 19 - 34.

                     TRS-80 MODELS I AND III

PARALLEL (TRS -- PROWRITER)   SERIAL (TRS -- PROWRITER)

1-------1   18-----27   1-------1
2------19   19-----10   2-------3
3-------2   20-----28   6|
4------20   21-----11   8| } *
5-------3   22-----29   20|-----20)
6------21   23-----12   7-------7
7-------4   24-----30
8------22   25-----13
9-------5   26-----31   *6,8,20 Jumpered Together
10-----23   27-----14
11------6   28-----32
12-----24   29-----15
13------7   30-----33
14-----25   31-----16
15------8   32-----34
16-----26   33-----17
17------9   34-----35

To obtain a line feed without a carriage return on the TRS-80 Model I
or III, do the following:
        SW1-7 Must be open
        SW2-6 Must be closed
The following software codes must be used:
10 LPRNT CHR$(27); CHR$(91); "THIS IS A TEST;" CHR$(138); "TO SEE IF
   THE LINEFEED WORKS O.K."

APPENDIX II: Dip Switch Settings

Your PROWRITER arrives ready to go. The DIP switches are set
for most-frequently used operation. A few must be changed for
correct interfacing with certain computers -- this is covered
in Appendix I. In this Appendix we describe general operational
switch settings -- and how to change printer operation
to suit you. I suggest you first become
familiar with general PROWRITER
operation, then consider customizing
it to your needs.

DIP SWITCHES

DIP stands for Dual Inline Pin. These
small, multiple- contact switches are
designed to fit into standard sockets
on printed-circuit boards. As used in
the PROWRITER, they permit you to select
alternative ways of doing things -- a
new character set or different Top of Form spacing, for instance.
Other switches are electronic adjustments and should be left
alone (we'll describe which is which!).

DIP switches can be represented like this:

SW7

Closed
Open

4   3 · 2   1
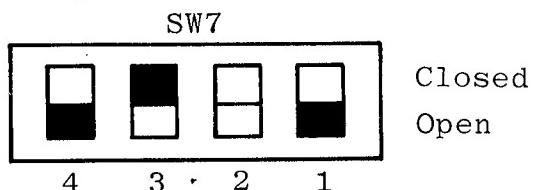
If this example switch were designated SW7, then the settings
shown would be:

        SW7-1   open
        SW7-2   doesn't matter (not connected)
        SW7-3   closed
        SW7-4   open

The PROWRITER has six DIP switches. Each switch contains
eight settings, or individual switches. Not all the settings
are used. They are located as shown in the drawing on the next
page. Locate the switches before you continue.

                        CAUTION

        Never change DIP switch settings with printer power
        turned on. Unplug the printer first. Use a thin,
        non-conductive tool to make changes. Do NOT use a
        pencil or screwdriver: serious damage to the printer
        may result.

(Top View)

Move right
sprocket ass'y
left to access
switches

Platen

Print Head

SW22
SW21
SW24
SW23

VR2   VR1
Impression   Alignment
Adj.   Adj.

SW1
SW2
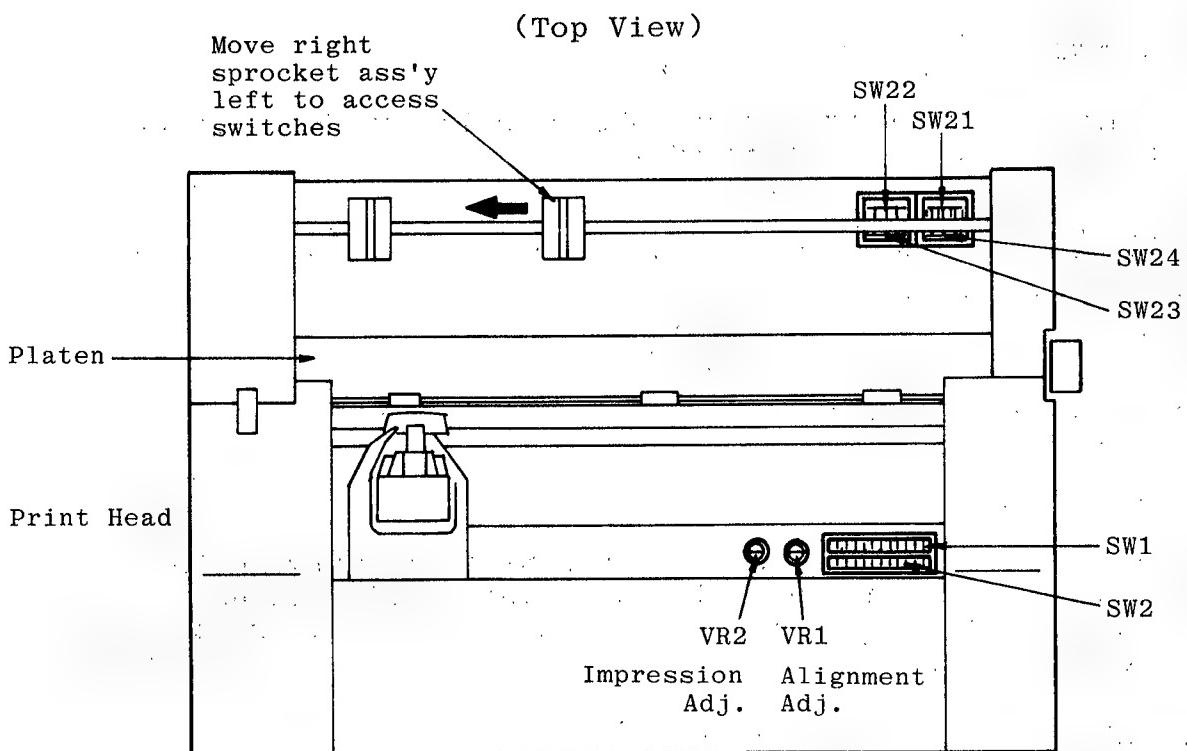
Right sprocket ass'y
will conceal SW21, 22, 23, 24
until moved left.

DIP SWITCHES SW1 AND SW2

SW1 and SW2 are positioned near the right front of the printer,
as shown in the illustration. Notice that each switch setting
is numbered: these are the numbers referred to as SW1-1,
SW2-5, and so forth. We'll describe each switch setting by
function. The normal (factory) setting for each switch is
indicated by an asterisk (*).

National Character Set

Set the first three switches in SW1 to select the character
set for the language you want to use. PROWRITER arrives
with the US character set selected.

CHARACTER SET	SW1-1	SW1-2	SW1-3	
Japan	OPEN	OPEN	OPEN	
United States	OPEN	CLOSED	OPEN	*
United Kingdom	CLOSED	CLOSED	OPEN	
German	OPEN	OPEN	CLOSED	
Swedish	CLOSED	OPEN	CLOSED	

TOF to TOF

The number of lines from Top-of-Form to Top-of-Form can be
either 66 or 72. The standard is 66.

NUMBER OF LINES
TOF TO TOF   SW1-4
----
66   OPEN *
72   CLOSED

SEL Input Signal

A SELect or DESelect signal can be sent from software to
place the printer on- and off-line. This signal is normally
effective. (Note: I don't recommend that you change this
setting!)

SEL/DESEL   SW1-5

Ineffective   CLOSED
Effective   OPEN *

LF When Data Buffer is Full

When the data buffer (printer memory) is full data is printed
either with or without a print command. Ordinarily, a LF
(line feed) command does not take place in this instance.

LF WITH FULL
BUFFER   SW1-6

Effective   CLOSED
Ineffective   OPEN *

Print Command Code

In the standard logic-seek mode, several commands in addition
to CR (carriage return) may also cause a carriage return.
CR only is standard. (This setting is ineffective in
incremental print mode, since each character is printed as
it's received.)

CR COMMAND
EXECUTED   SW1-7

CR only   OPEN *
CR,LF,VT,FF   CLOSED

A2-3

Line Feed Following CR

You may select a line feed (LF) to automatically follow a
carriage return (CR) command. Ordinarily, it does not.

FUNCTION	SW1-8
CR	OPEN *
CR + LF	CLOSED

This completes SW1 settings.

The Format of Zero (0)

Zero may be printed either with or without a slash. Without
is standard.

PRINT FORMAT	SW2-1
0	OPEN *
Ø	CLOSED

Memory Buffer Size

The printer memory buffer is normally 1K; 2K is an option.
This just means that the printer holds up to 1K (or 2K) of
print data at one time. This can be changed to one <u>line</u> of
data at a time.

BUFFER SIZE	SW2-2
1K or 3K	OPEN *
Single Line	CLOSED

SW2-3 and SW2-4: 8510B model only. See Appendix VI.

Character Pitch at Power-On

The printer ordinarily "wakes up" with pica (10 cpi) pitch
standard. This can be changed to make proportional spacing
the norm.

PRINT MODE	SW2-5
Pica (10 cpi)	OPEN *
Proportional Spacing	CLOSED

Seven- or Eight-Bit Data

Eight-bit data is required to use the Greek character set
or the graphics mode. Seven-bit is standard.

```
DATA                      SW2-6
-------------------------------
8-bit                     OPEN
7-bit                     CLOSED *
```

SELect or DESelect at Power-On

The 8510A is normally deselected when power is applied.

```
STATUS                    SW2-7
-------------------------------
SELect                    CLOSED
DESelect                  OPEN *
```

Bidirectional Print or Unidirectional Print

The 8510A normally prints in both directions. You may select
one-direction printing.

```
STATUS                    SW2-8
-------------------------------
Bidirectional             OPEN *
Unidirectional            CLOSED
```

This completes our description of switch settings for SW1
and SW2. The four DIP switches at the top of the printer
(as shown in the illustration) select certain electronic
parameters. A few settings are changed as described in Appendix
I to accomodate most computers. The others should not be
changed unless you have the appropriate technical background --
and a copy of the PROWRITER tech manual!

DIP SWITCH SETTINGS -- SERIAL INTERFACE

Using the 8510A with a serial interface is another
kettle of fish -- or another group of switches. Now
switches SW21 and SW22 (at the top right-hand side of
the printer) are used to select certain functions.
As with the parallel switch descriptions, an asterisk
indicates the standard factory setting.

Selection of Stop Bit 1 or 2

This is a technical setting most operators will not use.
One bit is standard.

NUMBER OF LINES	SW21-1	
One bit	OPEN	*
Two bits	CLOSED	

Selection of SD or CER

This switch setting is used only for the Japanese character
set, with CER. Otherwise, use the standard SD setting.

SD/CER	SW21-2	
SD	OPEN	*
CER	CLOSED	

Selection of Parity Check

The printer can be programmed to look for odd, even, or
no parity. Even parity is standard.

PARITY CHECK	SW21-3	SW21-4	
EVEN	OPEN	OPEN	*
ODD	CLOSED	OPEN	
NO PARITY	OPEN	CLOSED	
IGNORE	CLOSED	CLOSED	(do not use)

Selection of 7-Bit or 8-Bit Data

Eight-bit data is standard for the Serial Interface Mode.

DATA	SW21-6	
8-Bit	OPEN	*
7-Bit	CLOSED	

Selection of Data Protocol

Data protocol selection involves the manner in which printer signals are handled. It's another setting for technical service persons. RDY/BSY, in that order, is standard.

DATA	SW21-7	SW21-8	
RDY/BSY	OPEN	OPEN	*
(alternate)	CLOSED	OPEN	
XON/XOFF	OPEN	CLOSED	
ETX/ACK	CLOSED	CLOSED	

Selection of Data Transmission Speed

The PROWRITER can accept a wide range of data speeds. Speeds here are given in bauds; 1200 baud is standard.

SPEED	SW22-1	SW22-2	SW22-3	
9600	OPEN	OPEN	OPEN	
4800	OPEN	OPEN	CLOSED	
2400	OPEN	CLOSED	OPEN	
1200	OPEN	CLOSED	CLOSED	*
600	CLOSED	OPEN	OPEN	
300	CLOSED	OPEN	CLOSED	
200	CLOSED	CLOSED	OPEN	
110	CLOSED	CLOSED	CLOSED	

NOTE: Do not use a current loop at more than 2400BPS. At 9600BPS avoid the combination of 7-bit data, no parity, and one stop bit.

DIP SWITCH SETTINGS -- INTERFACE AND SPECIAL SIGNAL

What? More switch settings? More DIPs? Yep! These are for technicians only, and involve the settings required for the type of interface used with the printer and the signals related to it.

Selection of RS232C or 20ma Current Loop

Set this switch to correspond to the interface used.

INTERFACE	SW23-1	SW23-2	
RS232C	CLOSED	OPEN	*
20ma Current Loop	OPEN	CLOSED	

Selection of DSR

DSR must be set according to the interface used.

INTERFACE	SW23-3	SW23-4	SW23-5	
RS232C	OPEN	CLOSED	OPEN	*
20ma				
Current Loop	CLOSED	OPEN	OPEN	
Ignored	OPEN	OPEN	CLOSED	

Selection of DTR

DTR is set according to the Data Protocol used.

DTR	SW24-1	SW24-2	
RDY/BSY	CLOSED	OPEN	*
XON/XOFF,			
ETX/ACK	OPEN	CLOSED	

Selection of RTS or DTR

This switch selects either RTS or DTR.

SIGNAL	SW24-3	SW24-4	
RTS	OPEN	CLOSED	*
DTR	CLOSED	OPEN	

Selection of CTS

This switch permits you to use CTS or ignore it.

CTS	SW24-5	SW24-6	
Use	OPEN	CLOSED	
Don't Use	CLOSED	OPEN	*

CD Validity

CD validity is determined by switches 24-7 and 24-8.
It is not used in this printer.

That's it. Refer to this material any time you feel like
DIPping into the switch settings.

DIP Switch Settings (Parallel Data)

Here is a pictorial representation of the DIP Switch
settings we've described. Switches SW1 and SW2 are
visible at the front right of the printer when the
carrier cover is removed. Remember to use the correct
tool to change switch settings -- not a pencil!


```
  8 7 6 5 4 3 2 1
  ┌─────────────┐
  │ ▯▯▯▯▯▯▯▯ │  SW1
  │    OPEN     │
  └─────────────┘
```

National character set
TOF-to-TOF
DC1 and DC3 processing
LF or no LF when
DATA BUFFER is full
Print command code
Function of CR

```
  8 7 6 5 4 3 2 1
  ┌─────────────┐
  │ ▯▯▯▯▯▯▯▯ │  SW2
  │    OPEN     │
  └─────────────┘
```

Numeric display of 0
Selection of 3K buffer
or single line buffer
No function (OPEN)
Selection of character
pitch at POWER ON
Selection of 7-or 8-bit data
SELECT or DESELECT at
POWER ON
Bidirectional print or
unidirectional print

DIP SWITCHES

Location of four
serial DIP switches

| SW22 | SW21 |
| SW23 | SW24 |

Print head
cable

Location of
two parallel
DIP switches

Print
head

VR2   VR1
 O   O   SW1
Impress   Align   SW2

Front of printer

Parallel DIP Switch Functions and Locations

A2-9

DIP Switch Settings (Serial Data)

The set of four DIP switches at the upper right side of
the printer are used to set functions in the serial mode.

Serial Board

SW21

| 8 7 6 5 4 3 2 1 |
| OPEN |
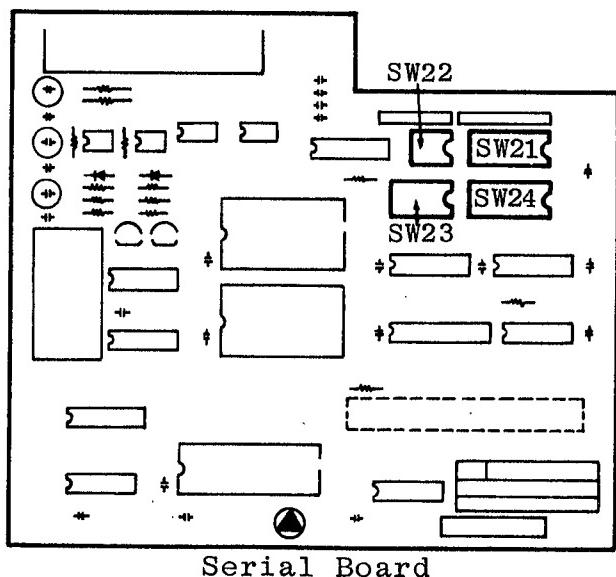
Selection of 1 or 2 stop bits
Selection of SD or CR
Selection of parity check
No function
Selection of 7- or 8-bit data
Selection of data protocol

SW22

| 4 3 2 1 |
| OPEN |
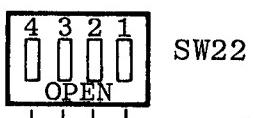
Selection of data
transmission speed
No function

SW24

| 8 7 6 5 4 3 2 1 |
| OPEN |
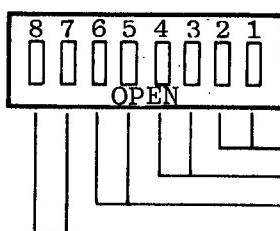
Selection of DTR
Selection of RTS or DTR
Use of CTS
Validity of CD

SW23

| 6 5 4 3 2 1 |
| OPEN |
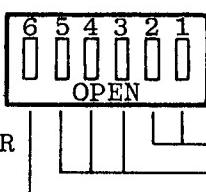
Selection of RS232C
or 20mA Current Loop
Selection of DSR
No function

Location of four
serial DIP switches

| SW22 | SW21 |
| SW23 | SW24 |

Print head

Print head
cable

Location of two
parallel
DIP switches

VR2   VR1   SW1
O   O   SW2
Impress Align

Front of printer
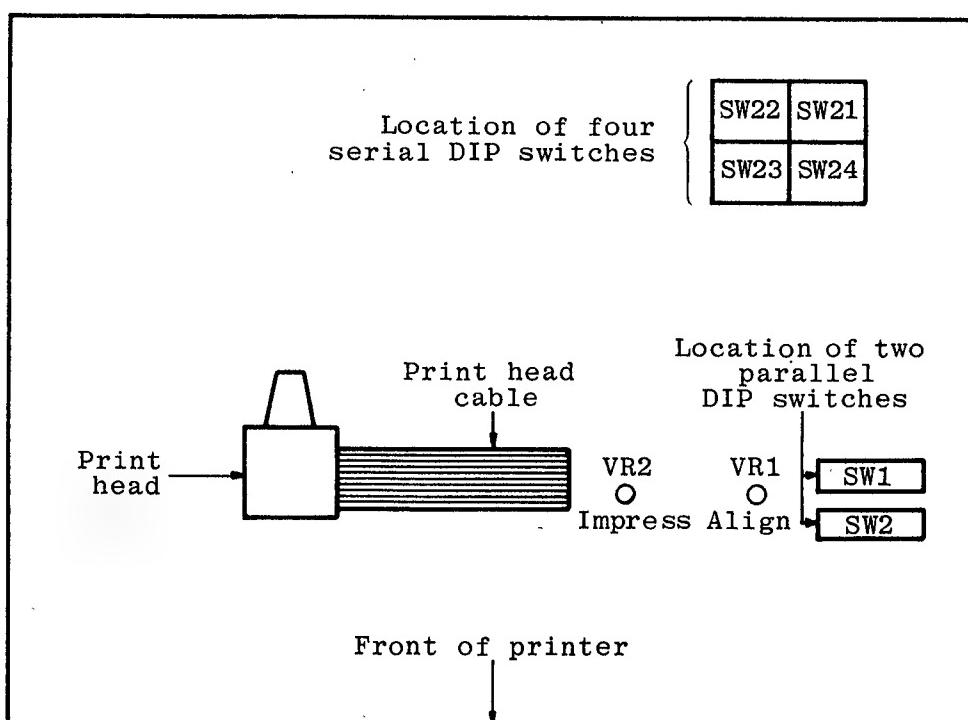
Serial DIP Switch Functions and Locations

APPENDIX III: Prowriter Character Sets

Here are the character sets referred to in Appendix II. Numbers are hexadecimal.

1. SPECIAL CHARACTERS FOR FOREIGN CHARACTER SETS

*No.	1	2	3	4	5	6	7	8	9	10	11
HEX.	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
US	$	@	[	\	]	^	`	{	|	}	~
UK	£										
GE		§	Ä	Ö	Ü			ä	ö	ü	β
SW	¤	E	Ä	Ö	Å	Ü	é	ä	ö	å	ü
JA				¥							

2. PROWRITER CHARACTER SET, 7- AND 8-BIT CODE The circled numbers refer to TABLE 1, above.

	0	1	2	3	4	5	6	7	8	9	A	B	O	D	E	F
0			SP	0	(*2)	P	(*7)	p	▬	┴	α	ρ	↑	1	═	✕
1	SOH	DC1	!	1	A	Q	a	q	▬	┬	β	δ	↓	2	⊨	....
2	STX	DC2	¨	2	B	R	b	r	▬	┤	γ	τ	←	3	≢	⋮
3	ETX	DC3	#	3	C	S	c	s	▬	├	δ	υ	→	4	⊣	⊥
4	EOT	DC4	(*1)	4	D	T	d	t	▬	─	ε	ø	±	5	◢	⊤
5	ENQ		.%	5	E	U	e	u	▬	─	ζ	χ	≠	6	◣	···|
6	ACK		&	6	F	V	f	v	▬	|	η	ψ	≥	7	◥	|···
7			'	7	G	W	g	w	▬	|	θ	ω	≤	8	◤	÷
8	BS	CAN	(	8	H	X	h	x	▮	⌐	∪	Δ	≈	9	♠	
9	HT	EM	)	9	I	Y	i	y	▮	⌐	κ	Γ	.	(	♥	
A	LF		*	:	J	Z	j	z	▮	···	λ	Σ	⊕	)	♦	
B	VT	ESC	+	;	K	(*3)	k	(*8)	▮	⌐	μ	Λ	∞	+	♣	
C	FF	FS	,	<	L	(*4)	l	(*9)	▮	(	ν	Ω	∴	-	●	
D	CR	GS	-	=	M	(*5)	m	(*10)	▮	)	ξ	¢	½	.	○	
E	SO	RS	.	>	N	(*6)	n	(*11)	▮	(	o	√	¼	*	/	
F	SI	US	/	?	O	-	o		+	⌐	π	□	°	´	\	

	2	3	4	5
0	─	⊥	═	✕
1	▬	┬	╞	- - - -
2	▬	┤	╪	┊
3	▬	├	╡	⊥
4	▬	─	◢	┬
5	▬	─	◣	┤
6	■	│	◥	├
7	■	│	◤	┼
8	│	┌	♠	
9	│	┐	♥	
A	│	└	♦	
B	▌	┘	♣	
C	█	╭	●	
D	█	╮	○	
E	█	╰	╱	
F	+	╯	╲	

	2	3	4	5
0	α	ρ	↑	1
1	β	σ	↓	2
2	γ	τ	←	3
3	δ	υ	→	4
4	ε	φ	±	5
5	ζ	χ	≠	6
6	η	ψ	≥	7
7	θ	ω	≤	8
8	ι	Δ	≈	9
9	κ	Γ	.	(
A	λ	Σ	⊕	)
B	μ	Λ	∞	+
C	ν	Ω	∴	−
D	ξ	¢	½	.
E	ο	√	¼	★
F	π	□	∘	´

ASCII	Dec	Hex		ASCII	Dec	Hex
NULL	0	00		@	64	40
SOH	1	01		A	65	41
STX	2	02		B	66	42
ETX	3	03		C	67	43
EOT	4	04		D	68	44
ENQ	5	05		E	69	45
ACK	6	06		F	70	46
BEL	7	07		G	71	47
BS	8	08		H	72	48
HT	9	09		I	73	49
LF	10	0A		J	74	4A
VT	11	0B		K	75	4B
FF	12	0C		L	76	4C
CR	13	0D		M	77	4D
SO	14	0E		N	78	4E
SI	15	0F		O	79	4F
DLE	16	10		P	80	50
DC1	17	11		Q	81	51
DC2	18	12		R	82	52
DC3	19	13		S	83	53
DC4	20	14		T	84	54
NAK	21	15		U	85	55
SYN	22	16		V	86	56
ETB	23	17		W	87	57
CAN	24	18		X	88	58
EM	25	19		Y	89	59
SUB	26	1A		Z	90	5A
ESC	27	1B		[	91	5B
FS	28	1C		/	92	5C
GS	29	1D		]	93	5D
RS	30	1E		^	94	5E
US	31	1F			95	5F
space	32	20		`	96	60
!	33	21		a	97	61
"	34	22		b	98	62
#	35	23		c	99	63
$	36	24		d	100	64
%	37	25		e	101	65
&	38	26		f	102	66
'	39	27		g	103	67
(	40	28		h	104	68
)	41	29		i	105	69
*	42	2A		j	106	6A
+	43	2B		k	107	6B
,	44	2C		l	108	6C
-	45	2D		m	109	6D
.	46	2E		n	110	6E
/	47	2F		o	111	6F
0	48	30		p	112	70
1	49	31		q	113	71
2	50	32		r	114	72
3	51	33		s	115	73
4	52	34		t	116	74
5	53	35		u	117	75
6	54	36		v	118	76
7	55	37		w	119	77
8	56	38		x	120	78
9	57	39		y	121	79
:	58	3A		z	122	7A
;	59	3B			123	7B
<	60	3C				124	7C
=	61	3D			125	7D
>	62	3E		~	126	7E
?	63	3F		DEL	127	7F

APPENDIX IV: Specifications

PROWRITER and PROWRITER II specifications are given in this Appendix.

PERFORMANCE SPECIFICATIONS

o	Print Method	Logic-Seek Printing or Incremental Printing
o	Print Speed	120 CPS (10CPI)
		63 LPM (10CPI)
o	Character Format	7(H) x 9(V) Dot Matrix (Alpha-Numeric Kana & Symbols)
		8(H) x 8(V) Dot Matrix (Character Generator-Based Graphics)
		8(H) x 8(V) Dot Matrix (Bit Image Graphic)
o	Characters	ASCII: 96
		JIS: 160
		Character Generator Based Graphic Fonts: 64
		European Characters: 14
		Hiragana (Option): 64
		Proportional Characters: 96
o	Character Pitch	Compressed Font: 17 CPI, 136 Char/Line
		Compressed Font: 8.5 CPI, 68 Char/Line Double Width
		Pica Pitch: 10 CPI, 80 Char/Line
		Pica Pitch: 5 CPI, 40 Char/Line Double Width
		Elite Pitch: 12 CPI, 96 Char/Line
		Elite Pitch: 6 CPI, 48 Char/Line Double Width
o	Paper Feed Direction	Forward, (Reverse)

o	Line Spacing	1/6", 1/8". N/144" (N = 0-99) (Minimum Pitch 1/144")
o	Line Feed Speed	Max. 100ms (1/6" Pitch)
o	Form Width	Max. 10"
o	Form Thickness	0.05 – 0.28mm
o	Number of Copies	Original + 3 (The total paper thickness may not exceed the range of 0.05-0.028mm)
o	Type of Form	Fan-Folded Sprocket Paper Rolled Paper Single Sheet Paper

PHYSICAL SPECIFICATIONS

o	Operating Temperature & Humidity	5 – 40°C, 10% – 85%RH
o	Storing Temperature & Humidity	-25 – +60°C, 10 – 90%RH
o	Power	115V ±10%, 60HZ
o	Power Consumption	Operating 180W max. Idling 16W
o	Weight	8.5Kg
o	Dimension	388(W); excluding knob x 285 (D) x 125 (H)mm; excluding lever

APPENDIX V: Printer Commands

This Appendix provides a summary of PROWRITER commands.
All numbers are decimal. Each command is shown both in
general format and in BASIC (CHR$) format. Commands are
fully described, with examples, in Chapters Two and Three
of this Manual.

COMMAND	DESCRIPTION	GENERAL FORMAT / BASIC FORMAT
Carriage Return	Returns carriage to left position	CR CHR$(13)
Line Feed	Moves paper up one line	LF CHR$(10)
Form Feed (Top of Form)	Advances paper one full page length from present position	FF CHR$(12)
Back Space	Moves the print head back one space	BS CHR$(08)
Set Tabs	Sets a tab at each column designated	ESC(,a,b,c. CHR$(27);CHR$(40); "a,b,c."
Clear All Tabs	Clears all tabs	ESC ∅ CHR$(27);CHR$(48)
Horizontal Tab	Sets carriage to next tab position	HT CHR$(09)
Pica Pitch	Sets 10 cpi pica pitch	ESC N CHR$(27);CHR$(78)
Elite Pitch	Sets 12 cpi elite pitch	ESC E CHR$(27);CHR$(69)
Compressed Pitch	Sets 17 cpi compressed pitch	ESC Q CHR$(27);CHR$(81)
Proportional	Selects Proportional Mode	ESC P CHR$(27);CHR$(80)
Elongated Character Select	Sets elongated character mode	SO CHR$(14)
Elongated Character Clear	Clears elongated character mode	SI CHR$(15)
Boldface Select	Sets boldface type mode	ESC ! CHR$(27);CHR$(33)
Boldface Clear	Clears boldface type mode	ESC " CHR$(27);CHR$(34)
Underline Select	Selects underlined text mode	ESC X CHR$(27);CHR$(88)

COMMAND	DESCRIPTION	GENERAL FORMAT BASIC FORMAT
Underline Clear	Clears underlined text mode	ESC Y CHR$(27);CHR$(89)
Character Repeat	Causes the next character to be printed nnn times	ESC R, nnn CHR$(27);CHR$(82); "nnn"
Line Feed 1/6 Inch	Sets 1/6 inch spacing between lines	ESC A CHR$(27);CHR$(65)
Line Feed 1/8 Inch	Sets 1/8 inch spacing between lines	ESC B CHR$(27);CHR$(66)
Custom Line Feed	Sets nn/144 inch spacing between lines	ESC T, nn CHR$(27);CHR$(84) "nn"
Forward Line Feed	Moves paper in normal (forward) direction	ESC f CHR$(27);CHR$(102)
Reverse Line Feed	Moves paper in re- verse (backward) direction	ESC r CHR$(27);CHR$(114)
Bidirectional Printing	Printer prints in both horizontal directions	ESC < CHR$(27);CHR$(60)
Unidirectional Printing	Printer prints in forward direction only	ESC > CHR$(27);CHR$(62)
Left Margin Set	Sets left margin to position nnn	ESC L, nnn CHR$(27);CHR$(76); "nnn"
Greek Characters	Selects Greek Character Set	ESC & CHR$(27);CHR$(38)
Graphic Symbols	Selects Graphic- Symbol Character Set	ESC # CHR$(27);CHR$(35)
Alphanumeric Characters	Selects (normal) alphanumeric char- acter set	ESC $ CHR$(27);CHR$(36)
Incremental Print Mode	Selects Incremental Print Mode	ESC CHR$(27);CHR$(91)
Logic Seek Mode	Selects (normal) logic-seek mode	ESC CHR$(27);CHR$(93)

DOT SPACING, BIT IMAGE GRAPHICS, and VERTICAL FORMATTING are
described in Chapter Four of this Manual.

APPENDIX VI: 8510B Operational Differences

The 8510B lets you select the right margin as well as the left.

Three right-margin stops are set up using the command:

        ESC /, a,b,c

Here, a.b. and c are the character positions at which the carriage will stop. In BASIC, this command is:

        CHR$(27);CHR$(47), a,b,c

The print position is determined by the current character pitch. Run this example with some print input to illustrate how the right margin can be moved:

        100 LPRINT CHR$(27);CHR$(47); 45, 53, 45

        110 .... (print copy)

The final print position does not change until you issue another right margin command.

Two notes before you experiment further:

> o   In the proportional character mode the margins are
>   set to pica width.

> o   The left margin setting does not affect this command.

CLOSING AND OPENING DIP SWITCHES FROM SOFTWARE

If you've ever wished, as I have, that there was an easier way to toggle those pesky DIP switches -- you're in luck. The 8510B uses two commands to open and close individual or groups of switches on SW1 or SW2.

Here's how it works. Each switch number is assigned a value that is a power of two. You select the switches to be opened or closed, and add their values. This value is used in the command. Suppose we want to close switches 1, 3, 7, and 8.

Switch #	1	2*	3	4	5*	6	7*	8*
Value	1	2	4	8	16	32	64	128

NOTE: Switches with an asterisk (*) cannot be set on bank two.

We add the values for switches 1,3,7, and 8:

    1+4+64+128 = 197

This is a unique number that specifies the combination of switches.

Let's use this number in the commands. The command to CLOSE
the switches is:

        ESC D ab OR in BASIC: CHR$(27); CHR$(68);CHR$(a);CHR$(b)

In this command (and the OPEN command), a and b represent
switches SW1 and SW2, respectively. To close the switches we
just selected on bank one, enter:

        100 LPRINT CHR$(27);CHR$(68); CHR$(∅); CHR$(197)

To OPEN DIP switches on SW1 or SW2, use the command:

        ESC Z ab OR: CHR$(27);CHR$(90);CHR$(a);CHR$(b)

These two lines of code OPEN switches 2,5, and 6 on SW1, and
switches 3 and 4 on SW2. They also CLOSE switches 1 and 8
on SW1 and switches 3 and 4 on SW2 (phew!). Work with the
commands until you understand this example -- then you'll have
this powerful tool at your disposal.

        100 LPRINT CHR$(27);CHR$(90);CHR$(50);CHR$(12)
        110 LPRINT CHR$(27);CHR$(68);CHR$(129);CHR$(32)

CHARACTER SET SELECTION

The 8510B model provides a wide selection of character sets.
They are selected with switches 1 through 4 of DIP switch
SW1.

In the chart below, X = OFF (OPEN), and O = ON (CLOSED).

Country	SW1-4	SW1-3	SW1-2	SW1-1
JA	X	X	X	X
FR	X	X	X	O
US	X	X	O	X
UK	X	X	O	O
GE	X	O	X	X
SW	X	O	X	O
IT	X	O	O	X
SP	X	O	O	O
DN	O	X	X	X
NOR	O	X	X	O
NET	O	X	O	X
FR II	O	O	O	X
UK II	O	O	O	O

TOP OF FORM LENGTH

The 8510B uses DIP switch SW2-3 to set the TOF-to-TOF
distance. With the switch OPEN the length is 66 lines,
which is standard. When the switch is CLOSED the length
becomes 72 lines.

LINE FEED PITCH

The line feed pitch at Power On is determined by DIP switch
SW2-4. When the switch is OPEN the pitch is 1/6"; when the
switch is CLOSED the pitch becomes 1/8".